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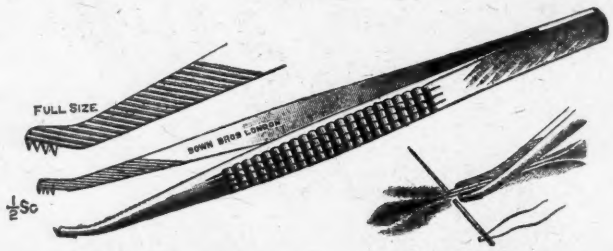

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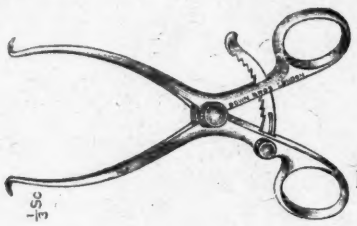

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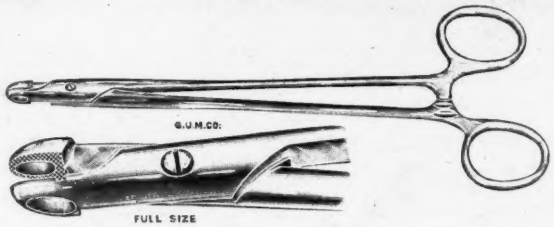

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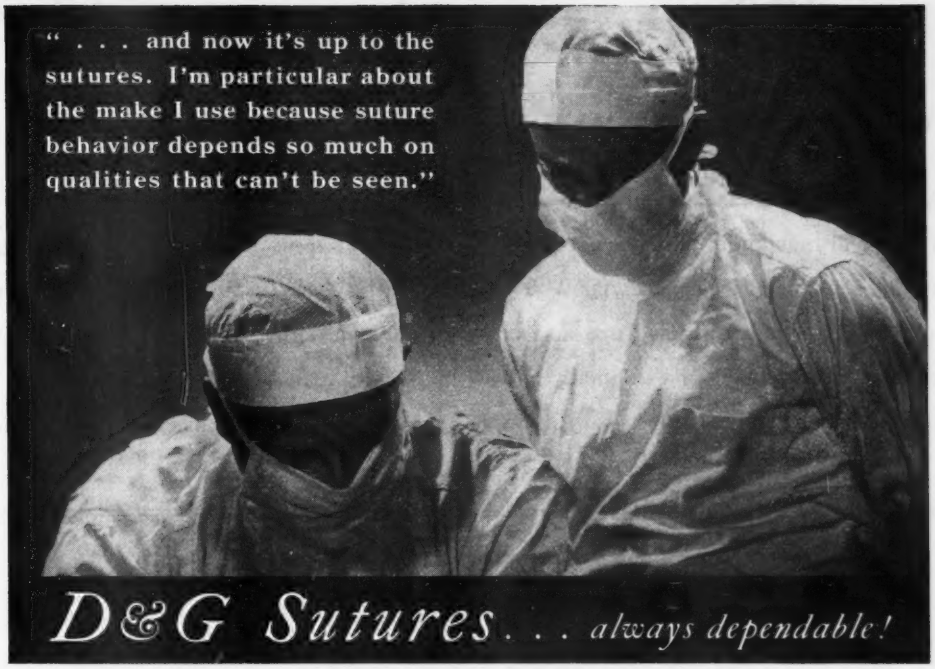
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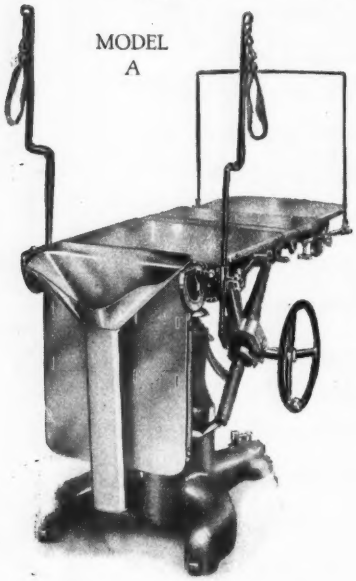

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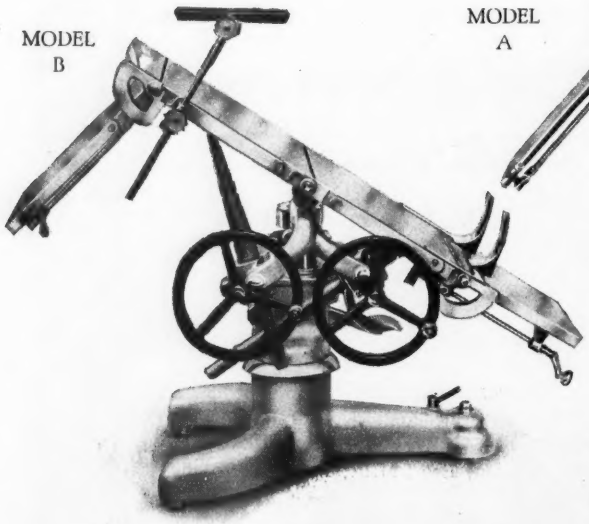

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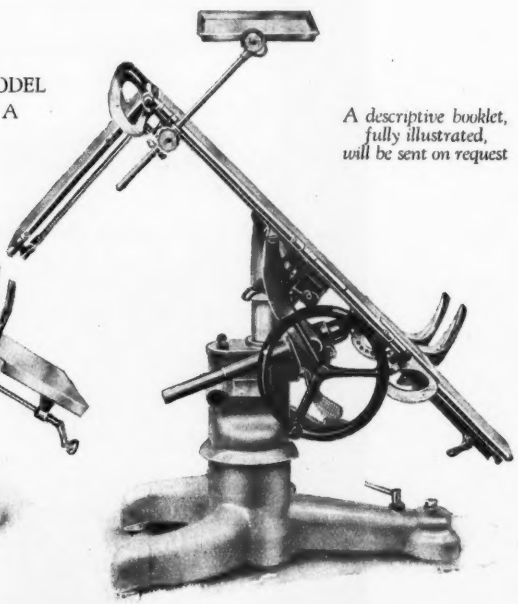

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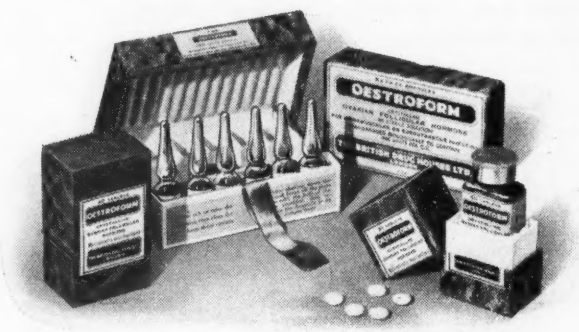

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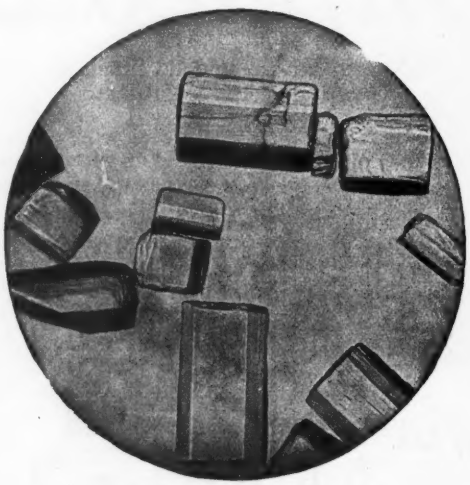

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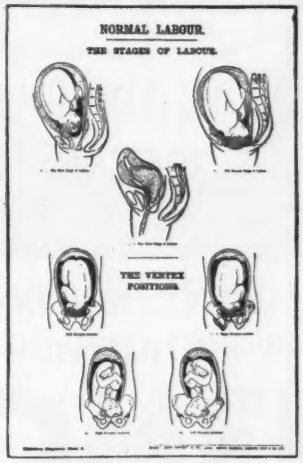

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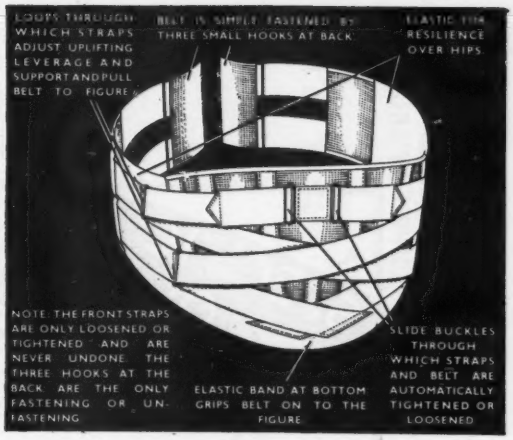
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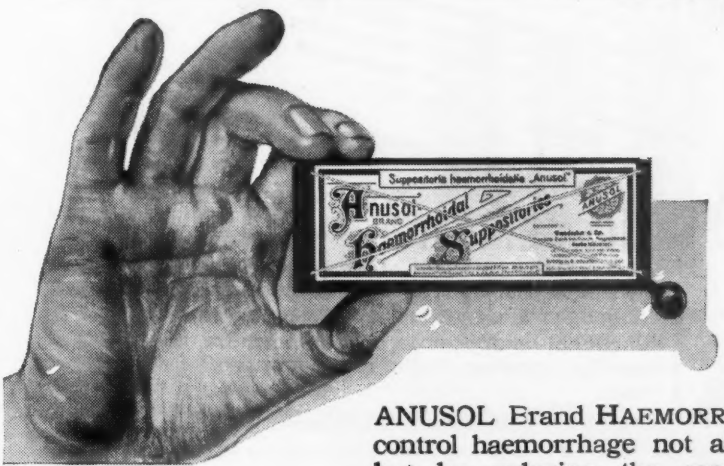

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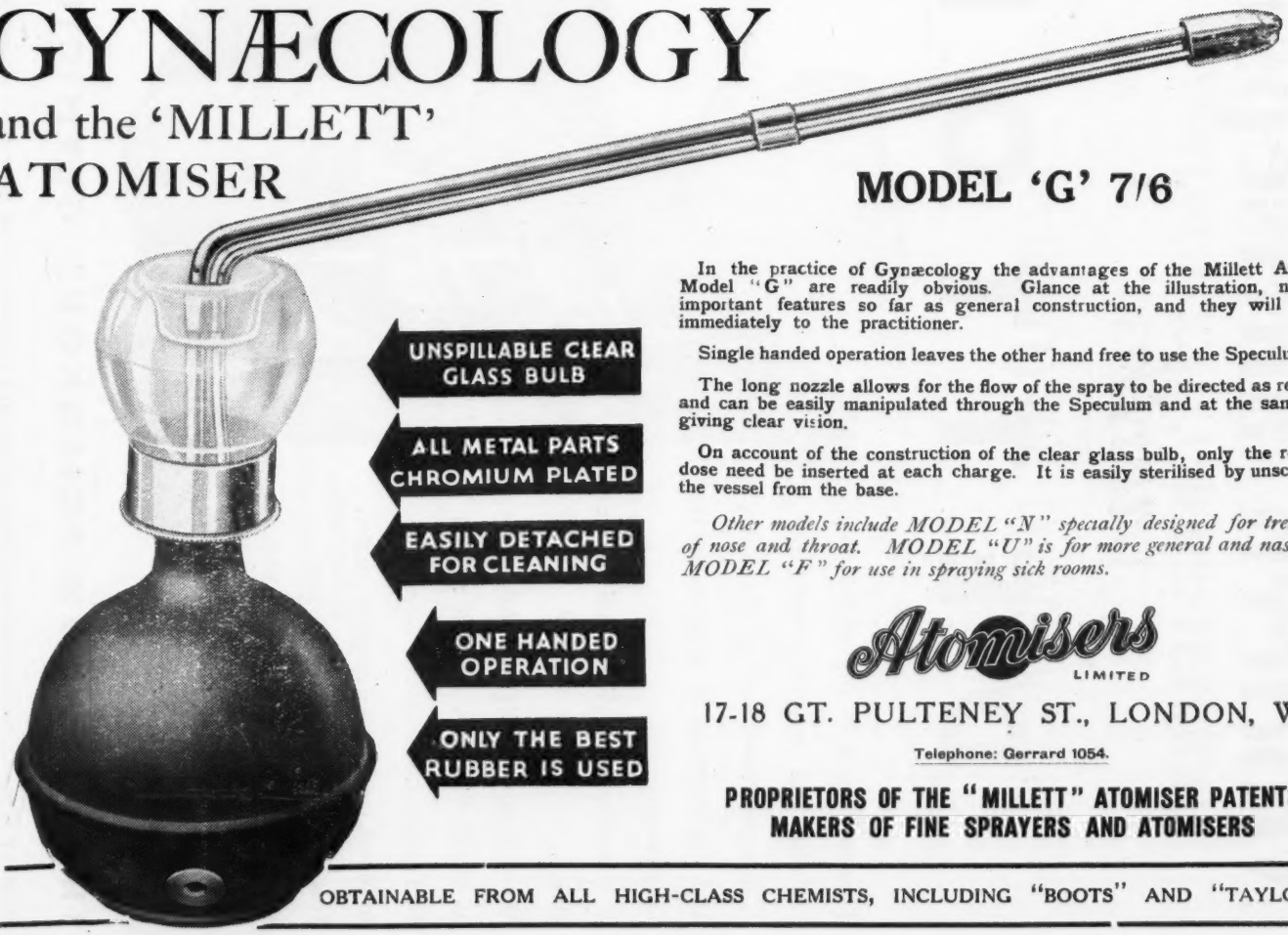
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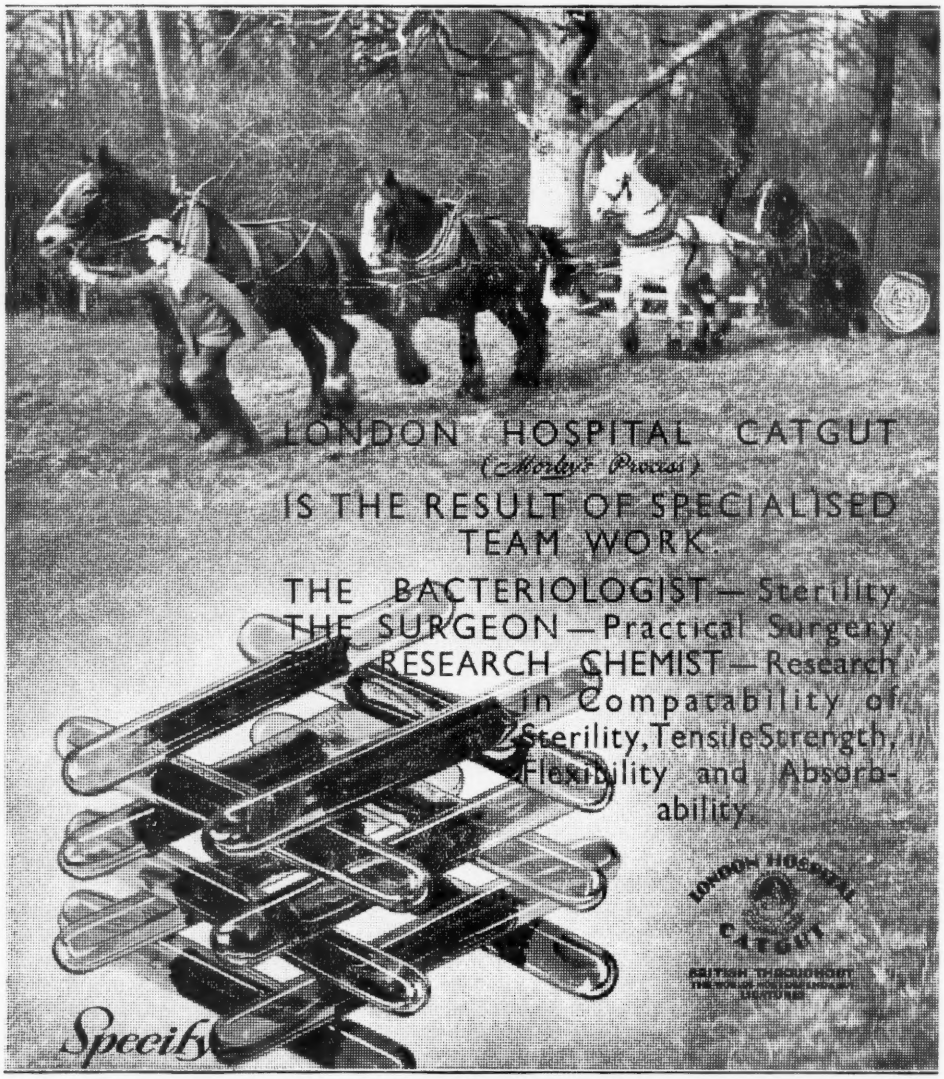
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The Treatment of Genital Prolapse

BY

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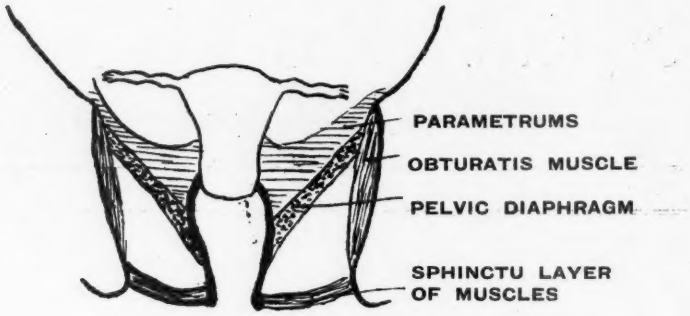
WHATEVER views have been expressed in old textbooks, it is now generally accepted by gynaecologists and anatomists that the female pelvic organs are retained in their normal position by the muscles of the pelvic floor and the parametrium.

The pelvis is closed below by a sheet of muscles which form a concave floor. The central fibres run antero-posteriorly from the pubes to the coccyx, the pubo-coccygeus muscle. Between this muscle and the obturator internus are the transverse and oblique fibres of the coccygeus and the ileo-coccygeus muscles, some of the fibres of which intersect those of the pubo-coccygeus. This muscular sheet is perforated in the midline by the urethra, the vagina and the rectum, the muscle fibres at their insertion into these tubes being carried downwards along these three structures for varying depths, and it is their muscular attachment which strengthens and retains in position the middle portions of these tubes.

These muscles form a funnel-shaped floor and the space between them and the upper portions of the perforating structures is filled by a fibro-muscular structure, the parametrium.



The parametrium forms a thick band of tissue at the base of each broad ligament which connects the cervix with the pelvic muscles and fascia, and it continues forward at the base of the utero-vesical ligaments and the bladder to be inserted into the pubes, and backwards at the base of the utero-sacral ligaments to be inserted into the sacrum.

This parametrium with the pelvic muscles is the most important structure in securing the uterus in position, as all gynaecologists recognize when performing pan-hysterectomy. In this operation cutting through the broad ligaments and the uterine artery has little effect upon the position of the uterus, but so soon as the deeper tissue, the parametrium at the base of the broad, utero-vesical and utero-sacral ligaments is cut, the uterus can be pulled out of the pelvis for a considerable distance, limited only by its attachment to the flexible vagina.

In the last number of this journal Victor Bonney[1] has given an interesting account of the anatomy of this structure and one which in broad principles expresses the views held by gynaecologists, except that the insertion of part of the parametrium into the cervix does prevent prolapse from being a purely vaginal phenomenon. The parametrium at the base of the broad ligaments he calls the cardinal ligaments of the vagina, and that at the base of the bladder and utero-vesical ligaments the peri-urethral wedge. Other authors have suggested other names. To be content with the old term "parametrium" would seem to be all that is necessary, and this would save confusion and simplify description.

Laxity through weakness or damage of the pelvic muscles and

parametrium is followed by prolapse of the pelvic organs, and without this laxity prolapse cannot occur. If this laxity involves the whole of the pelvic floor and parametrium there will be prolapse of all the pelvic organs, but when—as if often the case—the laxity is in excess in one position of the floor, the prolapse will be confined to—or be greatly in excess in—this position.

The urethra runs obliquely through the pubo-coccygeus muscle and the parametrium for the greater part of its length, and the sphincter action of the urethra is due almost entirely to the action of these surrounding muscle fibres. Any laxity of this muscular tissue allows undue dilatation of the urethra with stress incontinence.

More posteriorly the base of the bladder is separated from the anterior vaginal wall by fibres of this same muscle, the pubo-coccygeus, and the parametrium. Laxity in this position allows the anterior wall of the vagina and the bladder to sink downwards to form a cystocele.

Still more posteriorly the pubo-coccygeus is perforated by the vagina, and in the V-shaped cavity between this muscle and the uterus and vagina is found the greatest amount of parametrium. Any laxity of this tissue is followed by prolapse of the uterus.

The most posterior of the perforating tubes is the rectum. This carries with it some of the encircling fibres of the pubo-coccygeus and ileo-coccygeus, which are often called levator ani muscle. Surrounding the rectum, above the insertion of the levator-ani muscle, is the parametrium at the bases of the utero-sacral ligaments. Laxity of this parametrium and levator ani is followed by prolapse of the upper and middle portions of the posterior wall of the vagina. If the laxity is in the posterior fornix of the vagina there may be a true hernia of the pouch of Douglas. Below this the bulging vaginal wall is usually adherent to the rectum and so forms a true rectocele. The lower portions of the vaginal wall and rectum are separated by the perineal body and muscles. This muscular cone does not form part of the pelvic floor although it is connected with it. Stretching or tearing of this structure will be followed by rectocele but not by any prolapse of the uterus unless the parametrium and pubo-coccygeus are also damaged.

This is a simple exposition of the pelvic floor and the supports of the pelvic organs, and explains why stress incontinence, cystocele, prolapsus uteri, rectocele, are all part of the same condition. It is rare to find in any case only one of these local laxities, though one may be most marked due to the fact that the muscle

or parametrium in that part of the pelvic floor has received the greatest damage.

The one common factor in genital prolapse is weakness or damage of the pelvic floor, and without this genital prolapse cannot occur. Most commonly this weakness follows overstretching and damage during parturition, but in a small percentage of cases it is due to poor development. There are, however, secondary conditions which in many cases hasten or determine the production of prolapse:

1. Increased abdominal pressure due to:
   (*a*) Heavy work of abdominal muscles. This explains the greater prevalence of prolapse in Lancashire nulliparae.
   (*b*) Long continued coughing from chronic bronchitis. This is often the determining factor in old women.
   (*c*) Abdominal tumours.
2. Increased weight of the uterus pushing this organ downwards:
   (*a*) Small fibro-myomata.
   (*b*) Subinvolution.
3. Increased weight of the cervix pulling the uterus down:
   (*a*) Chronic cervicitis.
   (*b*) Cervical fibro-myomata.

These secondary causes play an important part in the production of genital prolapse and are sometimes even the determining cause, but they are powerless to act without some previous weakness or damage of the pelvic floor.

Treatment.

If the one common cause of prolapse is weakness of the supporting structure it seems rational to say that the one cure is an operation which strengthens these supports.

Some writers stress the differences in the types of prolapse—in one cystocele, in another rectocele, in another prolapse of the uterus, in still another stress—incontinence of urine—and argue from this that one operation cannot cure all types.

It is quite true that there are these different types of genital prolapse, but it is very rarely that one case exhibits one type only: one is frequently in excess of the others, but usually all four are present. This is only another way of saying that in every case there is weakness or damage of these supporting structures, but in one case the weakness is more manifest in the anterior portion of these structures, while in another the weakness is further back.

To argue that the operation of colporrhaphy is not suitable for all cases is to look upon this operation as conforming to some paper pattern. In practice, colporrhaphy, like all plastic operations, is modified to suit each case: In one a wider amount of tissue is removed from the anterior fornix; in another more care in suturing the muscles over the urethra; in another the suturing of a wider area of parametrium at the base of the broad ligaments; in another a wider area is removed from the posterior wall; and in still another greater care is necessary in suturing the parametrium below the utero-sacral ligaments to ensure closure of the hernia in the pouch of Douglas. It is this which gives the interest to the operation; it is this which gives it its difficulty and accounts for the many other operations still in use in various centres, though the gynaecological world is gradually recognizing its value, and more and more evidence is annually produced of its adoption in new centres.

Operations for the cure of genital prolapse are legion, but those most commonly performed can be divided into these classes.

1. Abdominal fixation of the uterus with or without colporrhaphy.
2. Hysterectomy.
3. Interposition.
4. Colporrhaphy.

Abdominal fixation by itself is useless, and when combined with colporrhaphy is unnecessary if the colporrhaphy is properly performed. Very occasionally a case is found with so little pelvic muscle or parametrium that ventral fixation is necessary in addition to colporrhaphy. In this series of 664 there were three such cases.

Hysterectomy by itself is worse than useless for the cure of genital prolapse, and the most difficult case to cure is the one with prolapse of the pelvic floor after hysterectomy has been performed.

Vaginal hysterectomy can be combined with colporrhaphy when—in addition to the genital prolapse—there is some condition of the uterus which calls for its removal. It must be understood, however, that this is a combination of two separate operations and that the hysterectomy is performed for the removal of the uterus, not as part of the cure of genital prolapse.

Interposition is an operation which can only be performed after

the menopause or after sterilizing the patient. The results of colporrhaphy after the menopause are so good that this interposition operation is never required.

Colporrhaphy is the one rational and generally successful method of curing genital prolapse. Usually both anterior and posterior colporrhaphy are combined with amputation of the cervix, but the amount of each depends upon the individual case, and in a few instances one part of this combination is not required.

In Manchester this operation has been continuously performed for this condition since the year 1888, when Archibald Donald first combined these procedures. From the first he emphasized the necessity of suturing the deep muscles and after his first three cases he always used catgut as the suture material. So good were his results that his method was soon adopted by his colleagues and later by all his pupils. At a later date Fothergill wrote extensively about the subject, but although his differed in some details from Donald's method, the principle was the same, and so it is with all the slight modifications used in the Manchester school at the present time. In a previous article[2] I gave a more detailed account of the history of the operation.

The method I now describe is the one used by myself: in some details it differs from the original operation of Donald and the one described by Fothergill, but in main principles it is the operation performed by Donald, which I learnt from him when I was his house surgeon.

The operation itself is most easily described by a series of diagrams.

The patient is placed in the lithotomy position, the vulva and vagina thoroughly cleansed and the cervix grasped by a vulsellum. In Manchester we always dilate the cervix and curette the uterus, and in the method of amputation we adopt this dilatation is essential.

Fig. 1 shows the prolapsed cervix. The left labium minus has been stitched back over the surrounding sterile towel. When the right labium minus is similarly treated a good view of the vagina is obtained, and a smooth, easily cleansed surface.

Fig. 2 shows a triangular area marked out on the anterior wall, with the apex below the urethral orifice and the base above the cervix. This triangle is widest some distance above the base. In complete procidentia this is an easy procedure, but with the more common case, in which the cervix comes only to the vulva, only the lower part of the triangle can at first be mapped out.

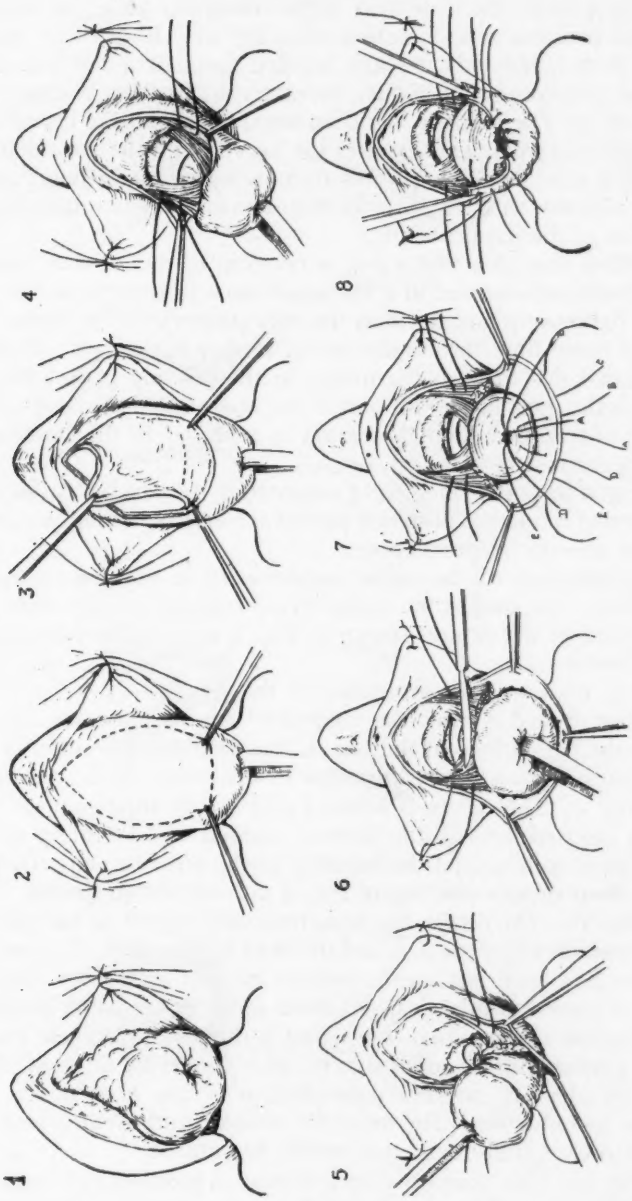

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Fig 3 shows the dissection of the triangular area. In cases of partial prolapse this dissection from the base is specially useful. The dotted line indicates the incision through a few muscular fibres and connective tissue, necessary to free the bladder.

Fig. 4. The bladder has been separated from the cervix and pushed upwards. This exposes the cervix with the parametrium on each side. Two deep sutures are now inserted, which include on each side the anterior fibres of the pubo-coccygeus muscle and a portion of the parametrium.

When these are tied a reef is taken in of these tissues, which are shortened and tied in a thickened mass in front of the cervix. This tightens up and thickens the only supports of the uterus and at the same time throws the cervix further backwards, which in its turn helps to keep the uterus in the position of anteflexion. This is the most important part of the operation, but these sutures must not be tied until the cervix is replaced in the position in which it must be retained.

Fig. 5 shows the method of amputating the cervix. An incision is carried round the posterior part of the cervix joining the angles of the anterior colporrhaphy.

Amputation of the cervix is necessary in the great majority of cases. Not only is the cervix hypertrophied in most cases, but the tying of the sutures shown in Fig. 4 tends further to obtrude the cervix.

Fig. 6 shows the amputation of the cervix.

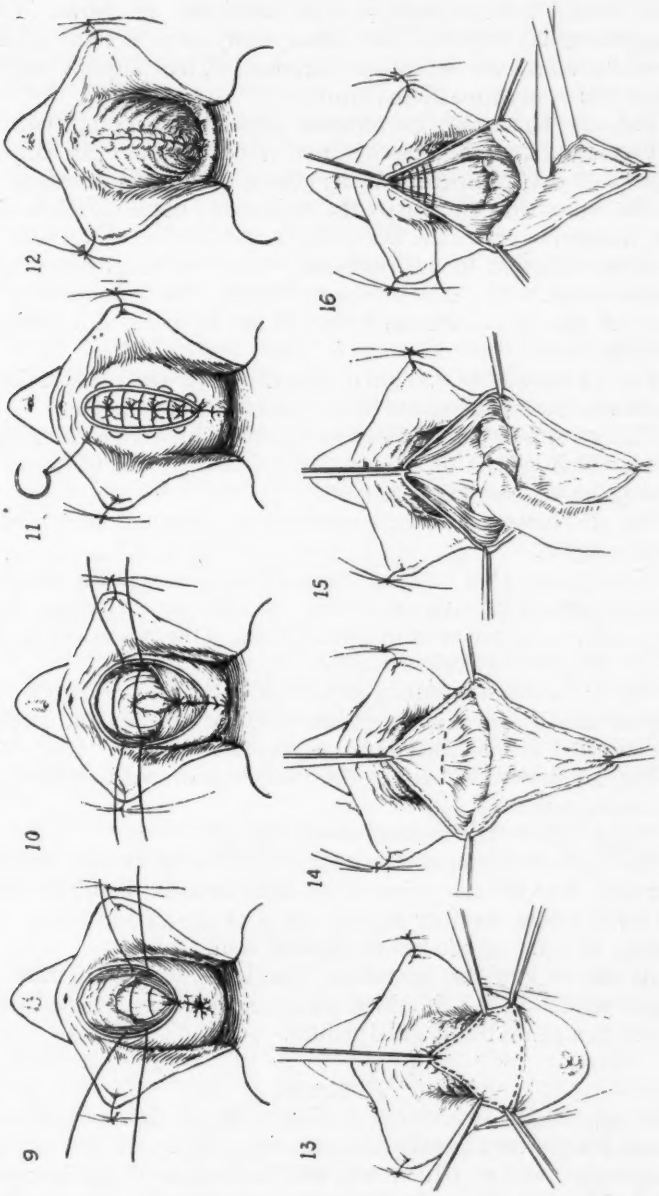
Figs. 7 and 8 show the method of suturing the vaginal flap over the cut surface of the cervix, the angles of the anterior colporrhaphy being sutured together in the centre of the cervix.

Fig. 9. The cervix is sutured and two or three sutures have been inserted through the anterior vaginal wall and deep muscle and so is commenced the suturing of the anterior colporrhaphy. The deep sutures inserted in Fig. 4 are still shown untied.

Fig. 10. The cervix has been replaced and the uterus put into the position of anteflexion and the deep sutures tied. If a cervical suture has been left uncut, tension on this will prove that the cervix cannot now be dragged down with reasonable pressure.

Further sutures are now inserted in the pubo-coccygeus muscle and parametrium in each side to close the hernia through which the bladder and urethra protruded in a case of cystocele and stress incontinence. The more the bladder and urethra protrude the more carefully must this muscle be sutured.

Fig. 11. This shows two deep sutures in position and a running suture to draw the cut edges of the vagina together. This super-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ficial suture can be either a continuous one, as shown in this diagram, or interrupted. Not infrequently there is some troublesome haemorrhage below the urethra. The simplest way to arrest this is by a mattress suture.

Fig. 12. This shows the anterior colporrhaphy completed.

Fig. 13 shows the commencement of the posterior colporrhaphy. A pair of Spencer Wells grasps the loose tissue near the cervix. Another pair grasps the redundant tissue on each side. The triangular area thus marked out is dissected away and the incision continued to the perineum where the angles are again caught—each with a pair of Spencer Wells. The amount of tissue removed depends upon the extent of the rectocele and varies in different cases.

Fig. 14 shows the triangular area dissected away and a dotted line the incision to separate the rectum from the vagina.

Fig. 15 shows this separation completed and indicates some tissue which is part of the levator ani and parametrium at the base of the utero-sacral ligaments.

Fig. 16 shows a running suture inserted through the cut edges of the vagina.

Fig. 17 shows the running stitch drawn tight and the two deep sutures inserted through the levator ani and parametrium. These deep sutures are the most important ones in the posterior, as they are in the anterior, colporrhaphy.

Fig. 18 shows the suturing of the vaginal edges completed. The deep sutures shown in the previous diagram are tied and another pair inserted into another layer of muscle.

Fig. 19 shows the skin of the perineum drawn together with a running suture.

Fig. 20 shows the reconstructed vulva.

Throughout the operation catgut alone is used as a suturing material. For the deep tissues separate sutures should be used, but for drawing together the cut edges of the vagina either continuous or separate stitches do equally well.

At the end of the operation I pack a little gauze into the vagina soaked in B.I.P. which prevents the gauze from adhering to and damaging the vaginal tissues.

Results.

I have made an attempt to follow up all the patients upon whom I have performed this operation during the seven years (1924–1930), and no patient was written to upon whom the operation had been done less than three years previously. The majority

of these patients were examined three to six months after the operation and found to be quite satisfactory, but recurrence is often a slow process, and it is useless to quote results from patients who have been operated upon only recently. I feel, however, that three years is a sufficiently long period to have elapsed after the operation and that any patient who is quite well at that time will have no recurrence. Unfortunately this length of time means that it is impossible to trace every case, and in this series I have received replies from only 664 patients.

A detailed questionnaire was sent to each patient, and those who replied that they were now entirely free from symptoms of any kind I have put down as "good results."

Every patient whose reply was not satisfactory I tried to investigate personally. Many of these were found to be complaining of conditions which had no relation to the original prolapse or even to the pelvic organs, and the colporrhaphy proved to be perfect. In the few cases in which I could not persuade the patient to come to see me I have classified the result as being "unsatisfactory".

In this series of 664 cases the results are:

Completely cured	640	or 96.38 per cent.
Unsatisfactory	24	or 3.61 per cent.

Of those whose results were not satisfactory five had subsequently borne children and the parturition is most probably the cause of the recurrence; five failed to come for further investigation and so are recorded as failures; one had a hernia through the vaginal scar; and nine showed some laxity of the posterior fornix.

Apart from those who had subsequently borne children only five had symptoms sufficiently severe to warrant any further operative treatment (0.75 per cent).

Mortality.

One of the great advantages of this operation is the slight risk to the patient. In this period of seven years there was one fatal case. This patient was admitted to hospital with a fever for which no cause could be found. Some time after this had settled the colporrhaphy was performed, the fever returned accompanied now by pain in the left side and pus in the urine. A post-mortem examination was not allowed, but in all probability death was due to recrudescence of an old renal infection.

In the 27 years in which I have performed this operation I can

find in my private and hospital records only 10 deaths: one each from pneumonia, cardiac failure, embolism, and septic absorption from a piece of gauze retained in the uterus, two from pyelitis due to operating too soon after an attack of cystitis, and in four the cause of death was not noted in the records.

During these 27 years I have records of 2,293 cases upon which I have performed the operation, and so the morality is only 0.43 per cent.

Chronic Pain.

Chronic pain in the lower abdomen and back is very frequently the earliest symptom of laxity of the pelvic floor and manifests itself before the patient herself is conscious of any prolapse of the uterus or vaginal walls—though this will follow if colporrhaphy is not done in the early stage.

In this series I find there are 97 patients who complained definitely of chronic aching pain and of these 87 were cured—that is 89.7 per cent and 10 were not cured—that is 10.3 per cent.

Incontinence of Urine.

In this series there are 27 patients who complained of incontinence of urine when straining, and of these three were not cured.

This is a large percentage of failure for this particular symptom, but it is only what might be expected as it is often difficult to find a satisfactory amount of muscle at the sides of the urethra, and even when this is found and brought together by deep sutures, it is a tissue which seems specially liable to research.

Subsequent Parturition.

As the condition is produced in the majority of cases by parturition and as the operation replaces the tissues as nearly as possible to their normal position, it might be expected that subsequent parturition would cause recurrence. The only case of prolapse in which it is justifiable to use some form of pessary is the young woman who intends to have more children. In these cases I usually advise the use of a rubber ring pessary until the family is completed, but if this does not make her comfortable it is better to perform colporrhaphy—though the patient should be warned that there is some risk of recurrence with subsequent labours.

In this series there are only 30 patients who had children after the operation, and of these only five showed any sign of recurrence—that is 16.5 per cent.

Another question which is often put to us by the patient is whether a subsequent pregnancy will be more difficult. I have never heard of any difficulty during labour in any of the patients upon whom I have operated. In all the years I have been associated with St. Mary's Hospital I have heard of two only in whom it seemed likely that delay in labour was due to a previous colporrhaphy. Much more frequently the labour is shortened owing to the removal of part of the cervix.

Results After the Menopause.

It is often stated that colporrhaphy is a useless operation for old women, and many surgeons advocate the use of the interposition operation. It is our experience in Manchester that the results in women past the menopause are as good as those in young women.

In this series there are 211 patients over 50 years of age—with the following results:

Cured	205 or 97.15 per cent.
Not cured	6 or 2.84 per cent.

Even in the six recurrences five are very slight. These five patients are all very much better, and in only one case is the trouble sufficient to warrant the patients' having any further operation. In four instances there is only a little laxity of the pelvic floor; in one a slight degree of cystocele with a slight return of incontinence of urine upon straining, while in one there is a definite return of the prolapse.

In this series there are five patients aged respectively: 70, 70, 71, 73 and 75—all of whom are cured. One of these at 73 years of age reports that she does her own work and can walk for miles.

Prolapse in Nulliparae.

The one common cause of prolapse of the pelvic organs is weakness of the pelvic floor. This is most commonly due to the stretching and tearing of parturition, but in some cases the pelvic floor and parametrium is not well developed, and if these women are subjected to heavy work, which increases the intra-abdominal pressure, the uterus or vaginal walls may protrude. This accounts for the more frequent occurrence of prolapse in nulliparae in the North than in the South as so many of our girls work heavy looms.

It might be expected that this type of case would give worse results as the condition is due to a primary weakness or deficiency

of the pelvic floor, but I find that the results are as good as in parous women.

In this series I obtained replies from 38 nulliparae: 37 were completely cured and only one showed any sign of recurrence, but in one of the cases so little muscle was found in the pelvic floor that a ventral fixation was done in addition to the colporrhaphy. Three of these patients were virgins of 63 years of age. One virgin—now over 60 years of age—reports that she is a weaver and does a full day's work looking after three looms.

The post-operative treatment and complication, and more detailed account of the technique and results, I dealt with in a previous paper.[2]

Summary.

1. The term "genital prolapse" includes stress incontinence, cystocele, prolapsus uteri, and rectocele.

2. All are due to the same cause—laxity of the pelvic muscles and parametrium.

3. All these conditions can be cured by the operation of colporrhaphy. In the majority of cases anterior and posterior colporrhaphy are combined with amputation of the cervix, but each case is treated on its own merits and the amount of tissue removed, and the care in the deep suturing depends upon the situation of the maximal laxity.

4. This operation is equally beneficial in old age as in youth—in nulliparae as in multiparae.

5. This operation does not cause trouble in subsequent labours.

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The Post-natal Development of the Genital Organs in the Albino Rat

With a Discussion of a New Theory of Sexual Differentiation.

BY

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I. Introduction

The theories of sex differentiation which are most widely accepted at the present time postulate that the differentiation of the anlagen of the accessory organs depends on the gonad. It is believed that the primordia of the genital organs are forced into male differentiation if and when the gonad develops into a testis and secretes male hormone; they become female if the gonad anlage assumes female type and produces a female hormone. This view implies that the chromosomic constitution which is ultimately decisive is the same in any and every cell; the sex determining factors would affect, however, only the development of the gonad thus influencing sexual differentiation but indirectly. The soma is said to be 'equipotential' (i.e., both male and female somatic cells would behave identically in an identical milieu intérieur). These views which vary in their attitude to specific questions may be termed 'dihormonic theories' since they involve the assumption that two distinct sex hormones guide the differentiation of the embyro.

In their original form the dihormonic theories were unable to explain, without adopting some absurd assumptions, the aetiology of even comparably simple abnormalities such as hypospadias peniscrotalis or pseudohermaphroditism. Goldschmidt, however, introduced certain new principles which he derived from his classical work on Lymantria and which threw a clearer light on the development of sexual monstrosities. To discuss his theories in this communication is neither possible nor necessary. But application of his principles to cases of peniscrotal hypospadias may illustrate Goldschmidt's point of view. He assumes that

the abnormal individual represents a genetic female which accordingly begins differentiation in female direction by developing an ovary. An ovarian hormone is secreted early in development and the external genital organs which differentiate early assume female character. But later the direction of gonadic development is reversed—the gonad now assumes male characteristics so that the subsequent differentiation of the accessory characters is controlled by male hormone. The internal genital characters respond even at this comparatively advanced stage of differentiation to gonadic secretion so that after the reversal of gonadic development (the "Drehpunkt" or "switchover") their development proceeds in male direction. The external characters can no longer respond. They have become fixed (determined) and thus retain their initial female character in spite of the presence of male hormone. It is obvious that the character of such a theoretical individual will be that of a sexual mosaic—predominantly female if the switchover of gonadic development has occurred late in development, predominantly male if the switchover has taken place at an early stage of development. An individual which thus has begun to differentiate in one direction but undergone subsequent sex reversal is called an *intersex*. Hypospadias peniscrotalis belongs to this type according to Goldschmidt. The relatively female character of the external organs is believed to be due to a female phase in the beginning of development followed by a male phase.

The premises and applications of Goldschmidt's theory will have to be discussed more fully below. At this juncture it is sufficient to show that even Goldschmidt's theory, which constituted a very great advance over the primitive earlier theories, is incapable of explaining certain types of teratological development, e.g., lateral mosaics.

In these cases a testis with more or less normal male accessories is developed on one side; on the other, an ovary with female appendages is found. Obviously, the classical theories of dihormonic development cannot explain these cases—it cannot be understood, on the basis of the theory or of any known facts, why the male hormone should act only on one side, the female exclusively on the other. The interpretation offered on the basis of Goldschmidt's theory assumed a differential rate of determination as cause of lateral heteronomy.* If, for instance,

*The term "determination" refers to the fixation of a character during development so that it persists even though the factors directing differentiation are no longer active.

determination occurs abnormally fast on one side this side may already be fully determined when the switchover occurs and the genital anlagen of this side may no longer react to the sex hormone secreted after the switchover. The other side, invested with a slow rate of determination, would still be capable of responding to the changed hormonic conditions and thus develop homonomously with the gonad. In this way sex reversal during development is believed to account for lateral heteronomy.

This theory has no factual basis. It assumes extraordinary differences in the rate of determination. It has already been pointed out by Witschi [2] that such differences, or anything approaching their degree, have never been demonstrated. Moreover, even in normal circumstances the determination of genital organs is less definite than that of many other organs. Thus the clitoris can respond even very late in development to male hormone by developing into a penis-like organ; yet the external genitalia of lateral mosaics are with few exceptions of female type and fail to show any influence of male hormone.

These and similar cases make it hard to accept the dihormonic theories even in their improved form. Nor can the latter explain why the presence of female hormone in the amniotic fluid of certain species does not affect male differentiation of the embryo. It has been suggested, in the resulting embarrassment, that the female hormone (oestrin) present in the amniotic fluid is not identical with the embryonic ovarian hormone which directs female differentiation; it still remains to be explained why the hypothetical embryonic female hormone of the free-martin fails to disturb the differentiation of the male twin of the free-martin.

These difficulties were realized early, and critical writers acknowledge that the dihormonic theories fail to explain abnormal development. Auxiliary hypotheses have been suggested; thus Bond [3] assumes that through some mechanism—say, loss of a chromosome during development—the genetic constitution of the soma becomes asymmetrical. Such an individual may have the constitution XX (female) on one side, X(O) (male) on the other side. In addition to this assumption yet another auxiliary hypothesis is introduced[1]: cells with a female constitution are said to react more readily to female hormone and vice versa; thus a testis and male accessories would develop, on one side, but the opposite side with the female constitution would not react to testicular hormone. This theory again has no factual basis. Capons, treated simultaneously with andro- and

thelykinin* develop male headfurnishings, but female plumage—that is to say, the characteristic effects of the sex hormones develop simultaneously and a genetically male organism thus grows female plumage in the presence of male hormone. Again, the free-martin, a genetic female, responds to male hormone in the presence of female hormone.

The failure of the dihormonic theories has prompted not a few authors to adhere to what may be termed the anhormonic theory. They hold that chromosomic constitution determines the direction of differentiation not only of the gonad but also of the accessory sex characters; the rôle of gonadic hormones is believed to be that of stimulants only. However, it is established that gonadic secretion does determine, at least to some extent, the character of the accessory organs. Thus the clitoris is transformed into a penis-like organ when testes are grafted upon a genetic female. The case of the free-martin offers, of course, the most complete proof for hormonic control of the differentiation of the sex characters in the female.

Thus the students of sex differentiation have not succeeded in producing a theory capable of accounting for the essential facts of both normal and teratological development. The nature of the observational and experimental data hitherto available is probably responsible for this failure; for while these data are very numerous they pertain mainly to advanced stages of development. Thus our knowledge of the action and rôle of hormones has been obtained in experiments on animals which approach, or have passed, puberty. At this phase of development the differentiation of the sexual characteristics is practically complete and the hormonal effects observed are consequently restricted to the activation of differential organs. The experiments do not reveal to what extent the preceding differentiation of the sexual organs depends on hormonal influences.

This question could only be answered by experiments on embryos for which adequate technique has not, as yet, been developed. The present writer [4] found, however, that, in the rat, the genital organs are incompletely differentiated even at birth. Differentiation proceeds for some weeks after birth so that the newborn rat is equivalent to the foetus of many other species. It seemed of interest, therefore, to study the phenomena and mechanisms of prepuberal development in this animal. Experiments on castration, oöphorectomy, injections of sex hormones,

* Thelykinin is used as a synonym for oestrin; androkinin for testicular hormone.

and other methods were, therefore, performed. The first section of the present communication presents the details of these experiments; the second expounds the tentative theoretical conclusions the writer feels inclined to draw.

II. The Post-natal Development of the Accessory Genital Organs of the Male.

Effects of Castration at Birth

In a previous attempt to study the conditions of genital development during infancy, the present writer[4, 5] chose the rat as experimental material since, in this species, the genital organs were found to be but little developed at birth. The results of the experiments involving castration and oöphorectomy indicated that the prepuberal development in the male depended on the testes, whereas in the female, gonadectomy did *not* effect any detectable disturbance of infantile development.

It would seem desirable to examine the effects of castration upon many if not all sexual dimorphic characters. But this was not necessary for the problem under discussion; the main question to be answered concerned the conditions governing the early development of those organs which have been shown to depend on testicular hormone for their maturation. Accordingly the glans penis and the seminal vesicles received most attention. It was found that the former undergoes intensive development during the first two weeks of life, so that any adverse specific influences of castration could be expected to become apparent in this organ.

Methods and Technique.

Animals not older than 12 hours were used in the experiments. Only litters containing at least three males were chosen. One or two males of each experimental litter were castrated; in every litter at least one animal was set aside as control. The controls were either castrated unilaterally or else a blank operation was performed in which both vaginal processes were opened. In some animals the testicles were exposed and lesions of the tunica albuginea were produced. In addition to these animals many intact males were examined.

The animals were weighed at various intervals. When they were killed, body-length, tail-length, anogenital distance and

body-weight were ascertained. For the former measurements Przibram's[6] procedure was adopted. The glans penis and the seminal vesicles were then measured; since the smallness of these organs makes direct measurement difficult, their image was measured on the screen of a micro-camera (Leitz Summar 42 mm.). The magnification used for these measurements and for the photographs was five times linear.

A number of specimens of the glans penis from animals other than new-born were badly damaged during sectioning; they had been prepared in the usual way before it was found that ossification of the os priapi (see below) occurs very early in life. In all subsequent preparations of the glans (excepting specimens from new-born animals) previous decalcification was employed.

Technique of Castration.

Ether was used as an anaesthetic in a few cases as in previous experiments on newborn rats.[4, 5, 7] In the great majority of animals a different technique, offering the advantage of low mortality, was employed.

It has been shown that the rat is incompletely homoiothermic; its body-temperature varies, to some extent, with the temperature of its environment. (Przibram, Bierens de Haan, Wiesner[6, 8]). In numerous observations and experiments on maternal behaviour[9] in which newborn rats were used it was observed that during the first days of its life the body-temperature of the rat—then unprotected by any fur—drops quickly when it is exposed to low temperature (which happens frequently if the mother rat has not built a nest). Under these conditions rat puppies up to four days old show a great reduction of spontaneous activity; when the mother returns and crouches over them their body temperature rises quickly, and they become very active.

In view of this experience a number of experiments was performed in which new-born rats were chilled till their body temperature fell to about 2°C.; it was found that they became completely immobile at this temperature and no longer reacted to any stimuli however severe. This result can be achieved by placing the little rat, strapped on filter-paper by small pieces of adhesive plaster on the coils of a refrigerator, or by leaving it for five to 15 minutes in a test-tube immersed in a thermos flask filled with ice. Care must be taken that the inner wall of the test-tube be dry (filter-paper lining), lest the skin of the rat freeze on to it.

The rats are operated on while immobilized. Their body temperature should not drop below about 1°C. Very little bleeding

results when such immobilized rats are used, since cardiac action ceases.[10] At ordinary room temperature immobilization lasts for three to 10 minutes, and may be prolonged by repeated cooling.

Bilateral castration can be completed in about three minutes. Two small incisions are made on either side of, and slightly cranial from, the genital papilla. Slight pressure on the abdomen pushes the testicles towards the wound; the vaginal process is then opened at its apex (i.e. caudal) and the testicle is pushed out by abdominal pressure. It is severed with a pair of iridectomy scissors or a cautery needle, ligature not being necessary. The skin is either sutured, or the edges of the wound are kept together by a thin film of amyl acetate. Ophthalmological instruments and intestinal needles are suitable for the operation.

The animals are left in a *cool* place for 10 to 30 minutes. They are then warmed gently by holding them in the palm of the closed hand or by keeping them in a warm place for about 20 minutes. When spontaneous activity has been restored and *not before then,* the animals are cleaned and returned to their mothers. It is advisable to wait till the animals are sufficiently warmed up to show the characteristic crawling (paddling) movements and the searching movements of the head.

The animals should not be replaced directly into the nest. It is advisable to leave at least one young with the mother till the operation is finished; this young is removed when the experimental animals are returned. Within a short time most mothers will begin to search for the litter. The experimental young are then deposited in front of the cage whence the mother retrieves them to the nest. When this procedure is adopted infanticide is hardly more frequent in experimental litters than it is otherwise.

It is also advisable to leave only the necessary controls with the experimental young and to kill off any young not actually required. Young which were operated on, or even only anaesthetized by chilling, do not develop as well as intact young for the first two to five days. This lag is enhanced if intact young are present, probably because the latter are stronger and interfere with the suckling of the weaker young; if this is prevented, the initial deceleration of development is compensated within a few days.

The Development of the Glans Penis in the Intact and Castrated Animals.

The glans penis can be bared, in the mature intact animal, by slight pressure on the walls of the dermal sac covering both

the glans itself and the distal portion of the corpus penis. The neck of the glans is not very distinct, even with the praeputium removed. Epithelial folds enter the body of the glans from the apex, from which also originate short and shallow, but clearly marked, sulci.

The colour of the mature glans in a healthy mature male is characteristic—the apical part of the glans is of a light red; its proximal margin receives its purplish colour from large sinuses.

The integument of the glans contains a great number of papillae (Plate II) of characteristic structure. Yet the surface is not as rough to the touch as might be expected from a histological examination, since large glands produce considerable quantities of smegma. It is doubtful whether these glands may be regarded as homologous to the praeputial glands with which they have been compared—just as it is incorrect to compare the dermal sack, which is often referred to as genital papilla, with the praeputium of the human. The latter is represented, in the rat, by a plica at the proximal end of the glans where the integument of the glans penis continues into the epithelial lining of the dermal sac.

The glans penis consists of two main structures, (*a*) the corpus cavernosum glandis, and (*b*) the "skeleton" with which is firmly connected the urogenital sinus and the cavernae accompanying the latter.

(*a*) The corpus cavernosum enfolds the internal constituents of the gland like a cloak and can be removed by a ventro-longitudinal* and a circular incision, the latter to be laid around the proximal end of the glans. Most of its dorsal trabeculae are arranged irregularly; but in the lateral regions of the corpus radial cavernae predominate; smooth muscle cells and fibres are present. The dorsal cavernae differ in size and shape from the lateral cavernae—the dorsal spaces are much larger, as a rule, and very irregular in shape. They frequently contain quantities of blood even though the penis be not erect; the lateral cavernae contain little blood in the resting organ. The two "half-circles" of the corpus cavernosum meet at the ventral side of the glans and, on superficial inspection, seem to merge; but close inspection shows that they are separated by a very narrow septum which represents the rudiments of a ligament running along the whole ventral side of the glans during the development

*The term "ventral" is used in the sense in which it is usually applied to the penis and refers to the facies urethralis. Strictly speaking, the terms "ventral" and "dorsal" should be interchanged in descriptions of the glans.[11]

of the latter and connecting the subcutaneous tissue of the dermal sac with the connective tissue spread between the corpus cavernosum and the skeleton of the glans. A small and thin frenular ligament at the neck of the glans and the narrow septum mentioned is all that ultimately remains of the ligament.

Among the central structures the os priapi is the most prominent. This bone has not been included in the Donaldson's catalogue[12] of the rat's skeleton. Yet there is no doubt that it is generally present. Every one of over 100 pubescent or adult males killed for various purposes and at various ages and examined for its presence possessed a well-developed os priapi.

The os priapi is a thin, slightly arched bone; as a rule it is solid, but in some cases it contains small cavities partly separated from each other by irregular ossified septa. Its proximal end (i.e. the end nearest the collum of the glans) broadens out into two tubercles separated by a shallow saddle. Its anterior end continues into a very prominent fibro-cartilaginous process (anterior process). So firm is this connexion between the process and the bone that attempts at dissection lead to lesions of the process, which is resistant to distortion. The process projects in young animals from the apex of the glans and can be identified even by macroscopic examination—particularly in animals not yet fully mature. In older animals it can be seen if the corpus cavernosum is pushed back.

The process is connected with two lateral fibrous tubercles so that the anterior end of the skeleton (bone plus process) has a complex triapical shape.

Ventrally from the os there lies the urogenital sinus. It is diverticulated; on cross-section it is approximately V-shaped and its distal portion is lined by stratified epithelium.

The urogenital sinus is associated with cavernous tissue. The latter is not very well developed in the proximal region of the glans, but is prominent in the median and anterior parts of the latter. In the median region the cavernous tissue lies above and/or on either side of the sinus urogenitalis; in the apical region it is developed most strongly in, or even restricted to, the region ventral from the sinus.

The corpus cavernosum glandis and the corpus cavernosum urogenitalis (urethrae) are not only derived from separate primordia, as is the case in many mammals, but also remains distinct throughout life. They are separated from each other by a fibro-muscular tunica and by loose connective tissue. The former surrounds the urogenital sinus with its accompanying cavernous

tissue and the skeleton. The loose connective tissue is spread between this tunica and the "cloak" represented by the corpus cavernosum glandis. It is usually well developed near the apex glandis, so that it is possible to push back the corpus cavernosum and to bare, to some extent, the anterior process and the distal portion of the urogenital canal.

The structure of the glans penis is further complicated by the presence of two strongly developed aggregates of fibrous tissue lying in the median region of the glans between the skeleton and the inner wall of the corpus cavernosum glandis, so that a swelling of the latter is not capable of compressing the urogenital sinus. Accessory cavernous spaces are situated between the os priapi and the fibrous tunica.

The corpus cavernosum corporis penis originates from symmetrical primordia which develop numerous lateral anastomoses; the corpus is enveloped by a strong fascia. It does not take part in the formation of the glans proper, since it terminates in the posterior region of the latter, its sheath being inserted firmly on the two terminal tubercles marking the proximal end of the os priapi.

Extra-uterine Development of the Glans Penis.

The glans penis of the new-born animal is very small (average length 1.7 mm.). It is covered by an undifferentiated epithelium which consists of one to three layers of cubical to columnar cells. This epithelium represents a continuation of the epithelium lining the inner wall of the dermal sheath. The transition from the integument of the penis to the lining of the dermal wall of the sheath is effected by (1) a longitudinal, medial, ventral fold, and by (2) a circular plica below the neck of the glans. Between the lining of the sheath and the integument of the glans, cells of embryonic character are spread so that the glans is closely attached to its sheath from which it cannot be removed without injury. There is no sharp demarcation between this inter-epithelial tissue and the integument of the penis.

Cross sections through the glans show that differentiation is as yet incomplete not only as regards the integument, which is smooth and contains not even anlagen of papillae, but also as regards the other structures. Beneath the integument there is found a zone containing undifferentiated cells with round or elongated nuclei. This zone represents the prospective outer wall of the corpus cavernosum glandis. The latter consists of undifferentiated cells not arranged in trabeculae, although some small and

irregular interstices are found. As a rule, this zone shows considerable mitotic activity. The os priapi is clearly demarcated, but does not show any trace of ossification. The ossifiable medium consists of large cells with faintly staining cytoplasm and is surrounded by a narrow zone of small cells with elongated nuclei. The anterior process is represented, in cross sections, by a limited area of small cells; the cytoplasm of the latter does not stain readily.

The loose connective tissue which separates the corpus cavernosum from the central structures in the apical region of the glans is distinct and well developed in some new-born animals.

The structure of the sinus urogenitalis in the apical region of the glans differs from that in the proximal region. In the former a low but clearly stratified epithelium lines the wall of the sinus, whereas in the proximal region the sinus is lined by eight to 12 layers of highly vacuolated cells with small, pyknotic nuclei. In several specimens a free lumen could not be detected; it was obstructed by the cells of this epithelium which is similar in structure to that formed in the vagina of the mouse and rat during puberal pro-oestrus in pregnancy and pseudo-pregnancy, and after injection of small quantities of cornifying hormone.[13 14]

During the first seven days post-partum a burst of growth and differentiation occurs. In animals seven days old an ossified os priapi of characteristic shape is already present. Ossification is most rapid in the median region of the os; the tubercles situated at the proximal end of the os remain unossified for a somewhat longer period than the median region. The apex also continues to grow and ossifies slowly. The anterior process which largely determines the shape of the apex glandis and causes its resistance to distortion, is already macroscopically discernible at this age. The cavernous tissue lying ventrally and laterally from the urogenital sinus has also developed; but its cavernae are not very numerous, and its trabeculae do not yet contain muscle cells; they consist mainly of undifferentiated cells with round or elongated nuclei. The corpus cavernosum glandis has grown in two directions, ventrally and distally. The septum medianum which enters the glans between the two leaves of the ventral epithelial fold is still rather wide. Radial cavernae are forming in the corpus cavernosum glandis, but the trabeculae, like those of the urogenital cavernosa, still consist mainly of indifferent cells. The integument, the connexion of which with the dermal wall of the dermal sac still persists, is smooth.

During the second week of extra-uterine life the glans con-

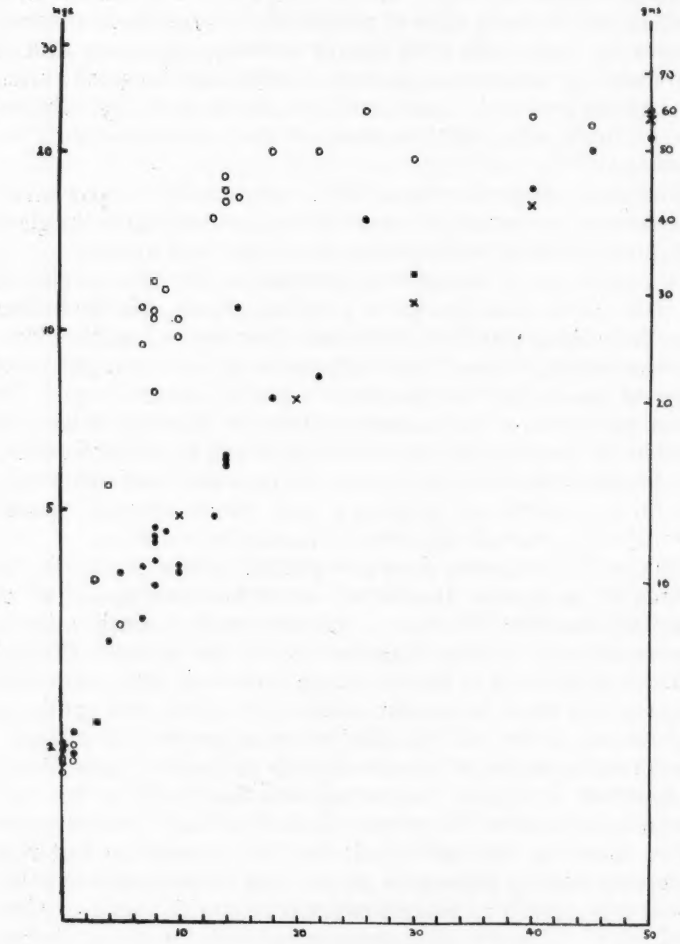


FIG. 1.

Growth of Glans Penis during the first seven weeks of extrauterine life. [*Arithlog grid.*]

- • Body weights (scale on right); author's data.
- o Weights of glans penis (scale on left); author's data.
- × Body weights according to Hatai's graduation. (see Donaldson).

A common point was assigned in the graph to the B.W. of a newborn male and the weight of its glans penis respectively. The two scales are thus comparable. Any weight established in more than one case has been entered only once.

tinues to grow rapidly; differentiation, however, is slower and mainly restricted to the integument. In the latter numerous anlagen of papillae develop during this period, but stratification does not begin until later.

During the following weeks the rate of growth and differentiation is considerably reduced. In animals five to six weeks old, however, differentiation is already far advanced, although muscle cells are still scarce in the trabecles of the corpus cavernosum. The corpus cavernosum glandis, as a whole, has grown considerably. The integument shows numerous papillae in advanced differentiation and, in some specimens, its connexion with the wall of the dermal sac (effected by inter-epithelial tissue and the median ventral plica) is already loosened or has disappeared save for the persistence of the circular plica and the frenulum which are permanent features.

The final development of the glans (further growth and development of numerous muscle fibres in the corpus cavernosum; complete disappearance of the inter-epithelial layer of cells, cornification of the papillae) occurs either before or after spermatogenesis has reached completion. However, these later stages are of no particular interest in the present context.

Actual measurements of the glans penis will be found in the table where data pertaining to some of the control animals have also been tabulated. In addition to these data the weights of the glans penis of a number of normal males selected at random from the stock have been plotted against age on an arithlog grid in Fig. I. together with the corresponding body-weights. The latter have been reduced to a scale which permits direct comparison of body-weight and glans-weight respectively. Although determination of the weight of the glans is to some degree arbitrary since the glans is not sharply demarcated, the data appear to indicate clearly a very high growth-rate of the glans during the first two weeks of life followed by a considerably reduced growth-rate during the following weeks of infancy. The glans grows in marked positive heterogony during the first fortnight postpartum, the constants for Huxley's[15] equation being ($b = .000285$) and ($k = 1.48$) respectively.

It seemed desirable to compare the growth-rate of the glans penis during the first weeks of life with that of puberty. Some difficulty is encountered in such a comparison since puberty cannot be ascribed to any definite age and represents in itself an ill-defined term. In the rat puberty consists of various processes, e.g., in the maturation of the genital organs, the completion of

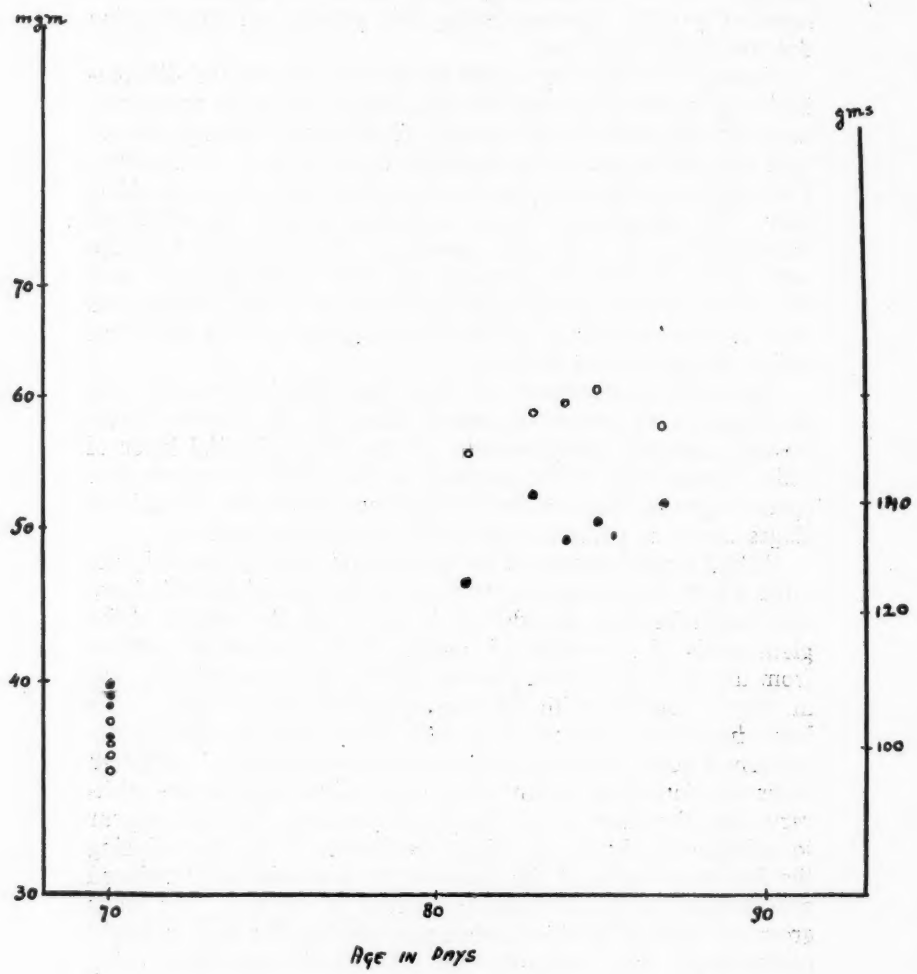


FIG. 2.

Growth-rate of Glans Penis during puberty (as defined by maturation of the Glans Penis).

For explanation, see Fig. 1.

Weight of glans not recorded in one case.
Ordinates.—Left: Weight of genital tract; right: Body-weight.

spermatogenesis and the occurrence of the sex drive and copulatory ability. The first appearance of these phenomena is noted at widely different ages. Moreover, any one of these phenomena may occur before the other, and the completion of sexual maturation, in the full sense of the word, may occupy as long as two to three months, copulatory ability occurring, in some cases, much later than complete maturation of the sexual organs. However, in order to make an approximate comparison possible, 10 males aged 70 days and belonging to three different litters were selected; in all of these males the glans was of prepuberal character. Four of these males were killed and the body-weight and the weight of the glans were determined. The six remaining animals were inspected daily and killed when the glans had attained mature character. A certain arbitrary element is inevitable in determining complete maturation, but may be neglected since the process of ultimate maturation of the glans was fairly rapid in these animals. At the age of 87 days the last of the six animals had a mature penis characterized by complete disappearance of the inter-epithelial cells, completion of the growth of the corpora cavernosa and the appearance of numerous papillae in the integument. The data thus collected were plotted in the same manner as the data referring to the young animals (Fig. 2).

It will be seen that the relative growth-rate of the glans penis during puberty slightly exceeded that of early infancy, the constants for Huxley's equation being ($b=.0000142$) and ($k=1.69$) respectively.

Effects of Castration.

Seventy-eight new-born males were castrated; 34 survived. Of these 27 were killed when 10 to 42 days old; seven animals were killed when 50 to 280 days old. In some animals herniae developed; otherwise a permanent disturbance of normal development was not noted. The weight of the castrates exceeded that of the controls in several instances by a considerable margin; in others it was lower. In all but two cases it fell within the normal range of variation during prepuberal development. Castrates permitted to live beyond the age of puberty became obese.

Castration performed at birth interferes, to a considerable extent, with the growth of the glans penis, but does not completely inhibit it. The glans increases in size after castration, but the rate of growth is considerably reduced as compared with the normal rate; the ultimate size reached by the glans is considerably below the normal. The reader is referred to Table I, which shows the measurements of the glans of the animals of those

TABLE I.

Litter No.	Animal No.	Operation	Age in days	Body-weight	Body-length	Ano-genital distance	Length of seminal vesicles	Glans penis	
								Length	Diameter
				gms.	mm.	mm.	mm.	mm.	mm.
1206	1	v	9	12·5	70	5·5	2·0	3·6	1·9
	2	c	9	13·0	72	5·0	1·0	2·8	1·6
861	1	c	11	11·5	72	7·5	1·3	2·6	1·6
	2	u	11	12·0	76	7·0	3·0	3·0	2·0
797	2	c	14	22·0	89	8·5	2·1	2·9	1·8
	3	c	14	20·2	91	8·0	2·0	3·1	1·6
	4	v	14	22·2	93	9·0	2·8	4·0	2·1
1172	2	c	14	26·0	89	9·0	1·8	3·2	1·4
	3	v	14	26·2	88	9·0	3·0	4·2	2·4
	4	c	14	25·5	92	8·0	1·6	3·2	1·6
668	1	c	17	18·0	79	7·5	1·4	3·0	1·8
	2	i	17	18·2	78	7·0	2·8	4·2	2·8
611	1	i	18	27·0	89	11·0	3·2	4·2	2·8
	2	u	18	26·2	96	11·5	3·0	4·4	2·6
	4	c	18	26·5	95	11·0	2·2	2·9	1·7
	5	u	18	27·0	95	10·0	3·0	4·0	2·6
608	2	i	21	27·0	91	13·0	2·8	4·8	2·8
	3	u	21	26·0	98	12·0	3·2	5·0	2·6
	4	c	21	26·5	99	10·5	2·4	2·8	1·8
	5	v	21	27·5	101	11·0	3·2	5·0	2·8
715	1	v	22	28·2	99	10·0	3·4	4·6	2·8
	2	c	22	26·8	94	9·0	2·2	3·2	1·6
	4	u	22	25·5	92	10·5	4·5	4·6	2·8
2503	1	v	24	36·0	110	13·0	—	4·2	2·8
	2	c	24	33·2	103	11·0	—	3·4	1·8
580	1	c	24	42·0	117	11·0	2·4	3·6	1·6
	2	u	24	48·0	—	12·0	4·4	4·2	2·4
549	1	u	26	41·2	112	15·0	3·5	4·4	2·6
	2	c	26	40·0	108	14·0	2·2	3·8	1·8
997	1	u	39	49·5	125	19·0	5·0	5·0	2·9
	2	c	39	52·5	137	16·0	1·6	2·8	1·6
	4	u	39	47·5	128	18·0	4·6	4·8	2·8
1250	1	c	44	39·2	116	17·0	2·4	3·2	1·8
	4	c	44	34·8	112	10·0	2·8	3·4	1·8
	6		44	39·8	114	18·5	4·5	4·8	2·8
1253	4	v	57	52·5	129	16·0	6·5	5·5	2·8
	6	c	57	48·5	114	9·5	2·4	3·6	1·8
954	1	c	72	84·0	152	18·0	2·6	3·8	2·0
	2	u	72	89·2	154	13·0	5·5	5·0	2·8
855	3	c	84	139·5	—	13·5	2·4	3·6	2·0
	4	u	84	128·0	—	24·5	7·5	7·6	3·8

i—entire control. u—unilateral castrate.
c—castrate. v—control with opened vaginal processes

experimental litters in which the weight of any castrate did not deviate from that of the heaviest control animal by more than ±15 per cent, so that differences in body-weight cannot account for the observed differences in the size of the gland.

It will be seen that when control and experimental animals are compared the differences in the development of the glans become manifest during the first 10 days of life. These differences increase as the animals grow older, since the growth of the penis of the castrate ceases almost completely after the tenth to the fourteenth day of life. Whether animals were compared on the basis of equivalent age, or equivalent body-weight, the glans of any castrate was found to be smaller than the smallest glans of any entire male (including controls).

In castrates killed after the age of puberty the glans was found to be of a somewhat abnormal shape, being more elongated than the glans of any prepuberal male whether castrated or entire.

The differentiation of the glans is also interfered with by castration performed at birth but, like growth in size, it is not completely inhibited. The effects of castration differ with respect to the various constituents of the glans.

In castrates killed at ages ranging from 10 to 14 days, the anterior process of the os is completely absent. The absence of the process simplifies the structure of the apex glandis. The os priapi, on the other hand, has undergone ossification; it has the same shape as the os of the entire male, but is distinctly thinner and somewhat shorter; it also appears that the rate of ossification is reduced by castration. The sinus urogenitalis is not distinctly affected. The cavernous tissue accompanying the sinus in the castrate is less extensive than in the entire male. Narrow lateral cavernae have developed but are few in number and irregular. Ventral cavernae are greatly under-developed, being represented only by a few narrow interstices. The connective tissue separating the central structures from the corpus cavernosum glandis is well developed. The corpus itself is not only narrower than is the case in the entire male, but it is also incompletely differentiated. Cavernae are present, but they are mostly of round shape instead of being arranged radially and the trabecles are very narrow. In some sections the parenchyma of the corpus cavernosum resembles reticulated connective tissue rather than the cavernous tissue of the entire male. The integument shows anlagen of papillae; their number varies, in cross-sections of the median region of the glans, from 20 to 68, whereas the range of variation in the entire male is 70 to 120.

During the subsequent weeks differentiation ceases almost entirely in the castrate. The anterior process remains absent; the integument does not undergo stratification and the anlagen of the papillae do not complete their development; in fact, their number in the glans of the adult castrate is reduced as compared with the castrate aged 14 days. The inter-epithelial tissue persists and the glans of the castrate is thus permanently fused with the lining of the dermal sheath. The corpus cavernosum also fails to continue its development. Normal trabeculae were not found in any castrate at any age, and it appears that, to some degree, de-differentiation can take place in the corpus cavernosum glandis after the second week of life. For in the older castrates killed after the fortieth day of life, the parenchyma of the corpus consisted either of a rather solid connective tissue, with but few and narrow interstices, or else it consisted of reticulated connective tissue. The former type of tissue is found mainly near the apex of the glans, the latter in the median region.

On the other hand, small and atypical cavernae were found ventrally from the urogenital sinus in some of the older castrates, although they were absent in the specimen killed before the fifteenth day of life.

The corpus cavernosum penis is as much affected by castration as the corpus cavernosum glandis. It fails to develop typical trabecles and its parenchyma resembles reticulated connective tissue.

Summarizing, it may be concluded that castration interfered both with the growth and with the differentiation of the glans penis. The effects of castration become noticeable within one week after castration, and differences between the entire and the castrated male increase with age. Apart from the decrease of the growth rate and the reduction of the growth limit, the most obvious effects of castration are (1) complete absence of the anterior process which is formed, in the entire male, during the first week of life; (2) incomplete differentiation (followed by partial de-differentiation) of the corpus cavernosum glandis; (3) incomplete differentiation of the integument.

The Seminal Vesicles.

The seminal vesicles of the mature animal are prominent glands of lobulated appearance; closely associated with them are found the ducts of the coagulating gland. As is already known, the secretory function of these glands depends on

testicular secretion. Recent investigations have been concerned with the cytology of the secretory elements in relation to testicular hormone. (Moore *et al.*[16]) A detailed description of these glands in their mature and prepuberal state is, therefore, unnecessary.

In the newborn animal the seminal vesicles can be discerned macroscopically. They do not exhibit the characteristic lobulated shape of the mature and prepuberal gland, but are small, slightly curved, smooth sacs. Microscopically, they are found to be of very simple structure, entirely lacking the diverticula which are found in older animals. Numerous such diverticula form during the first six weeks of life and their development is accompanied by a proliferation of the ducts of the coagulating gland which are very few in number in the newborn animal. The formation of recesses is accompanied by the development of the typical lobulated appearance of the gland. The latter is already attained at the age of 10 days, when the length of the gland (apex to base) is several times that of the newborn gland.

Growth in size and increase in the complexity of the cavities occur concurrently with the differentiation of the wall of the gland. In the newborn animal the wall consists of indifferent cells; but during the first three weeks of life differentiation occurs so that, in the prepuberal animal, numerous muscle fibres are found. During pubescence the wall thickens. The epithelium of the gland in the newborn animal consists of cubical to columnar cells. In animals older than seven days the epithelial cells are almost all columnar. Secretory activity does not become distinct before the thirty-fifth day of life.

Castration performed at birth does not completely inhibit the growth and differentiation of the glands, but it reduces the growth-rate, so that differences between the glands of the entire and castrated male respectively are evident even in animals killed at an age of seven days. The growth of the seminal vesicles and the coagulating gland of the castrate ceases almost completely after this age; thus with respect to size, the glands of an adult castrate equal those of an entire male aged about two weeks. The differentiation of the wall also ceases very soon after castration; but it is sufficient to produce muscle cells though their number and density do not equal those of the entire male. In castrates killed after the age of puberty, indications of a partial de-differentiation were detected; comparatively few muscle fibres were present, whereas connective tissue cells were numerous. The epithelium does not seem to be immediately affected by

castration at birth, since no consistent differences between controls and castrates were detected in animals aged seven to 14 days. Needless to say, it remains inactive and its cells ultimately exhibit the appearance depicted by Moore, Hughes and Gallagher (Plate II, Fig. 17).[16] However, it is possible that closer cytological examination, for which the material under discussion was unsuitable, would lead to the detection of cytological differences even at a very early age.

The Ano-Genital Distance.

The ano-genital distance constitutes, in the rat, a sex dimorphic character, for the distance between the anus and the orifice of the urogenital papillae (enclosing clitoris and penis in the female and male respectively), is much longer in the male. In the newborn male the ano-genital distance averages 2.8 mm. and the ratio (ano-genital distance divided by body-length*) averages 0.06. At the age of about six weeks the average ano-genital distance equals 21.0 mm.; the average ratio (ano-genital distance divided by body-length) equals 0.14 (Donaldson's data[12] and writer's measurements). The ano-genital distance obviously exhibits heterogonic growth even during infancy.

Castration does not affect this development during the first six weeks in any consistent manner. Some castrates killed before the age of 54 days showed an ano-genital distance distinctly shorter than that of the controls; in others a significant difference was not detected.

In castrates older than seven weeks the ano-genital distance was shorter than in controls of approximately equal or even somewhat lower body-weight; the greatest length observed was 25 mm.† in the controls and 18 mm. in the castrates. The highest ratio (ano-genital distance divided by body-length) in the castrates was only 0.12 as against 0.18 in the controls.

The perineal sac which represents, in the rat, the homologue of the scrotum, showed a well-developed cavity in all castrates even when no hernia had occurred. It appears that this cavity was somewhat less voluminous than in the controls; on the other hand it was sometimes distended to a considerable degree when a hernia had developed.

* Distance from tip of nose to centre of anus, animal lying on its back.
† In fully grown males the ano-genital distance may exceed this measurement.

Effects of Unilateral Castration and other Control Operations.

Unilateral castration did not interfere, in any instance, with genital development. In four animals in which the tunica albuginea was opened, the testes atrophied. When the animals were killed (at the age of 17 days) the genital organs were found to be of castrate character. The opening of the tunica vaginalis led to atrophy of the testes and castration-effects in four animals, while in seven animals genital development was normal. These animals were killed when 14 to 42 days old.

The descent of the testis in the animals castrated unilaterally was not impaired. Testicular weights were not determined so that information regarding the occurrence of compensatory hypertrophy is not available. Twenty-one testes were sectioned; the histological findings generally agreed with those of Hewer[17] and need not be detailed here; the time sequence of developmental stages in the cases under discussion differed somewhat from those observed by Hewer[17] and Allen.[18] The latter author, using Wistar rats, finds that spermatocytes have differentiated by the eighth to eleventh day of life, while spermatozoa may be found in animals aged 37 days. No spermatocytes were present in the material examined before the fourteenth day of life. The youngest specimen showing ripe spermatozoa was 42 days old. Variations in the rate of testicular development are of a very wide range; but it appears that development is uniformly very rapid during the first week of life. The average number of tubules counted in 24 cross-sections through the median zone (region of greatest diameter) of seven newborn testes was 62; the corresponding number in 23 sections through five testes of animals aged seven days was 113. Whereas a lumen is not present in the tubules of the newborn testis, interstitial elements abound.

Discussion.

It has been shown that the glans penis and the seminal vesicles undergo pronounced development during the first weeks of life. The relative development of the glans penis during the first fortnight of life parallels the development occurring during puberty. Not only is the relative growth-rate almost as high in the newborn animal as in the pubescent male, but processes of differentiation also occur during the first 14 days which transform a comparatively undifferentiated organ into that highly complex structure represented by the prepuberal glans penis.

Similarly the seminal vesicles undergo rapid development during the first weeks of life, and speaking generally, it appears that this early period of genital development is perhaps *of greater biological complexity than puberal development itself.*

Like puberal development, the early growth and differentiation of the genital organs appears to depend, in the rat, on the presence of the testicles. It is very unlikely that the surgical interference to which the experimental animals were subjected can be held responsible for the effects observed. It might be held that the normal development occurring after unilateral castration does not exclude the possibility that bilateral castration may interfere more thoroughly with the differentiation and growth of the glans penis, since of necessity the operation must be carried out in the close vicinity of the vessels which supply the fragile glans penis of the newborn animal. But it has been found that an operation as severe in all important respects as bilateral castration itself—viz. the removal of the apex of the tunica vaginalis—does not interfere in the majority of cases with normal differentiation. Moreover, the seminal vesicles which are protected against direct damage caused by the operation itself, show marked reduction in their growth-rate and partial arrest of their differentiation.

It seems reasonable to assume, therefore, that the rapid development of the glans penis and the seminal vesicles during the first fortnight of extra-uterine life depends as much on testicular function as puberal development itself. This conclusion will be subjected to further examination. (See p. 893.)

The data for length and maximum diameter of the glans penis show that the growth of this organ is arrested, or almost arrested, very soon after castration; the photographs reproduced on Plate I (Fig. 1–6) may serve to illustrate this effect. There is only a very small difference in the size of the glans penis of castrates aged 14 and 85 days respectively; nor is the glans penis of a castrate aged 240 days any larger. Yet the body-weight of a castrate 240 days old exceeds that of the castrate aged 14 days by about 1800 per cent. Similar relations are found when the remaining data are compared; thus one cannot assume that the independent development (growth uninfluenced by sex hormones) of the sex characters exhibits the same growth-rate as the organism as a whole, the gonadic secretion serving only as stimulus for heterogonic growth.

The effects of castration on growth, significant as they are, seem of less significance than the effects on differentiation. The

results show that castration does not simply produce a sexual system *en miniature*, but actually interferes with the development of the elements which, in the entire male, are transformed during extra-uterine life from more or less unspecific embryonic tissue into highly differentiated tissue. But the influence of castration on differentiation varies greatly with respect to the various constituents of the glans penis and they have to be considered separately.

The integument is of particular interest in this context. Its normal development which results in the formation of papillae and a high degree of stratification is accompanied by the atrophy of the loose connective tissue spread between the surface of the glans and the wall of the dermal sac. Thus the unspecialized epithelium of the glans of the newborn male is transformed into a very specialized organ which has in common with the general integument of the body, the formation of keratin layers, but differs from it through the absence of glandular elements or hair, and the presence of papillae. The effects of castration on the integument are adequately described as "delayed arrest"; for the stage of development reached by the castrate at the age of two to four weeks (persistence of the inter-epithelial tissue, presence of anlagen of papillae) corresponds to a transitory phase through which the normal animal passes in early life. Yet it will be noted that this arrest of differentiation does not become effective immediately after castration. The formation of primordial papillae in the intact animal begins only during the second week of life. At the same age such anlagen are formed in the castrate —i.e. a certain degree of differentiation becomes manifest about a fortnight after castration. This development might be regarded as occurring independently of testicular secretion; such an assumption would not be unlikely for there is every reason to assume, on the basis of embryological findings, that the anlagen of the urogenital system are formed without the collaboration of any gonadic hormone.* But this interpretation of the observation is probably not correct. For, as has been mentioned, the number of orimentary papillae is small in the castrate of any age as compared with the entire male even though the latter be immature. This difference may be regarded as an indication

*Allen and Deakin are inclined to regard the formation of the Müllerian duct as homodynamic with the development of the gonadic oriments. This, however, does not apply to the anlagen of the external genitalia or to the Wolffian duct.[19]

that the testicular secretion plays a rôle not only in the final development, but also in the formation, of the rudiments of the papillae. It seems likely, therefore, that castration does not prevent the occurrence of all papillary anlagen since the integument is already partially determined at birth.

From this point of view the formation in the castrate of anlagen of papillae would represent the delayed manifestation of a determining influence of testicular secretion. The completion of determination before the beginning of differentiation is a very general feature of development. Thus the laterality of the anlagen of the limbs of an amphibian is determined before the limb buds appear.

The stratification of the integument of the glans which occurs in normal animals and fails to take place in the castrate, may be of some interest when a comparison between the female and the male is made. It is well known that the ovary secretes a hormone which produces stratification and intra-epithelial cornification of the epithelial lining of the vagina. It is possible that the development of the integument of the glans penis, involving keratinization, represents an action of the testicular secretion corresponding to the cornifying effects of the oestrifying hormone. Further experiments will be necessary to examine this possibility.

The dependence, in the rat, of the papillae of the penis on testicular secretion corresponds to an effect of castration observed in the guinea-pig. The "horny styles" of the penis of this species are said to regress after castration.[20] Similar observations were made in the cat (Retterer and Lelièvre, quoted after Meisenheimer).[21]

While the development of the integument in the castrate represents an arrest of differentiation, the development of the corpus cavernosum after castration cannot be described by this term. It was found that the anlage of the corpus cavernosum is transformed into connective tissue of varying character ranging from a loose network to cell aggregates which are either solid or else show irregular interstices. This appearance is never found in the intact animal and, therefore, does not represent a stage transitory in normal development but fixed by castration. Castration leads to the transformation of the anlage, which is a potential corpus cavernosum with its complicated pattern of trabeculae and cavernae, into an unspecified tissue.

The effect of castration on the anterior process of the os priapi, which fails to develop, must be practically instantaneous; for in

the entire male, the anterior process is formed during the first week of life. The os priapi is not influenced by castration—except for a diminution of the growth rate and an early termination of increase in size; while ossification does occur in the castrate. Similarly, the distal portion of the urogenital sinus develops a stratified epithelium in the castrate as in the entire male.

It appears, therefore, that the effects of castration as regards differentiation are distinctly graded. One extreme effect is represented by the behaviour of the os priapi in which a distinct qualitative influence of castration cannot be detected; the other extreme by the effect upon the anterior process, where development is completely arrested. It is hardly possible to co-ordinate this differential effect with the histological appearance of the various anlagen at birth, although the os priapi—which is least affected—shows the highest degree of differentiation in the penis of the newborn male. On the other hand, anlagen of papillae are not visible in the newborn animal, while the anlage of the anterior process is distinct. Yet some of the former do appear while the latter fails to develop in the castrate.

It must be concluded that the degree of determination attained at the time of birth by the various constituents of the glans penis varies very greatly and does not completely correspond with the degree of differentiation reached at birth; the anlage of the os is completely determined and can develop (though only into a "miniature" bone) without further stimulation by testicular secretion, while the anlage of the anterior process, yet incompletely determined, cannot develop without the presence of this secretion.

It has been shown that the development of the seminal vesicles is arrested by castration save for a slight increase in length. It will have been noted that actual atrophy of either the vesicles as a whole, or of the epithelium in particular, does not take place after castration. The epithelium of the seminal vesicles of castrates at the age of seven to 14 days is found to be equivalent to that of intact animals seven to 14 days old. This may seem surprising, since it is well known that the epithelial elements of the seminal vesicle of the adult male respond profoundly to castration; the disappearance of secretory activity resulting from this operation becomes apparent within 10 days. But it must be considered that the development of the seminal vesicles during the first five weeks of life is extremely slow so far as the epithelium is concerned. No changes, save the assumption of a more generally

columnar character by the epithelial cells and a slight increase in the height of the cells, occur during this period. The absence of any pronounced epithelial development during this phase conditions the absence of any well-defined changes after ablation of the gonads. On the other hand, it seems of a certain interest to note that a level of testicular secretion which suffices to incite the development of the glans penis fails to activate the epithelium of the seminal vesicles. During the earliest phases of extra-uterine life the epithelium which, in the adult rat, is extremely sensitive to withdrawal of testicular secretion, is apparently less sensitive than the glans penis or certain constituents of the latter (anterior process, integument, corpora cavernosa).

The effects of castration discussed in the preceding paragraphs indicate that testicular secretion is active even during infancy. So far as the male is concerned, puberty cannot be defined as the phase of life at which gonadic secretion first occurs (Marshall[22]), or recurs after a latent phase represented by infancy.[20] It is more appropriate to regard puberty (represented by the attainment of a completely functional state of the sex organs and accessory characters) as an effect of an intensification of a mechanism already active during infancy. In view of Steinach's[23–28] experiments and the extensive studies of the Chicago workers, there can be no doubt that this intensification consists largely in an increase of testicular secretion; though other factors (i.e. factors influencing the reactivity of the sex organs) may also play a certain rôle.

The conclusion that testicular secretion is present during infancy and is necessary for the normal development of the sex organs, may not be applicable to species other than the rat. Lipschütz[20] is of the opinion that puberty occurs in "two phases"; the term "puberty" denoting, in this case, the development of maleness. The first phase is represented by sexual differentiation and genital development of the embryo; the second by actual maturation (i.e. puberty in the usual meaning of the word). Between these two phases—that is, between birth and the commencement of testicular secretion—there is interposed, according to Lipschütz, a phase when the development of the sex organs proceeds but slowly and is independent of the testicle. This view is based on experiments with rabbits. The actual data of the experiments have not been published so that criticism is not possible. Similarly, Steinach and Kun[29] state in a footnote to one of their communications that prepuberal development of the penis of the guinea-pig is not dependent on testicular secretion. Again, data

are not given. It is, therefore, impossible to arrive at any definite conclusion regarding the conditions of postnatal genital development in animals other than the rat.

III. Effects of Androkinin in Males Castrated at Birth.

In the previous section the post-natal differentiation of the male genitalia has been described, and it has been concluded that castration is followed by incomplete differentiation. A testicular hormone appeared to be responsible for the development of the genital organs in early life. It remained to determine whether the substance which conditions the growth of the cock's comb[30, 16, 31, 32] and has been shown to activate the epithelium of the accessory genital glands, would also repair the deficiencies caused by castration. Experiments with a preparation of androkinin were therefore undertaken.

Newborn male rats were castrated by the technique described previously. They received injections of the extract for varying periods and were killed when three weeks old. The penis and other genital organs were sectioned and then measured.

Only two animals which had received injections on the day of, or the day after, this operation survived for more than two days; the remaining nine animals received their first injection on the fifth day of life. Five animals survived and received injections again on the eleventh, fourteenth and seventeenth days respectively; they were killed when 21 days old.

Proviron was used. The solution contained 50 mgm. of the active substance per cc. The substance was supplied with the information that 1 mgm. contained two "Hahnenkammeinheiten", the latter not being defined in greater detail. Only a small quantity was available for experimental purposes and control standardization was, therefore, not carried out.*

Control experiments with pure maize oil were also carried out. These experiments showed that the lethal action of the extract upon the newborn males could not be ascribed to the active substance it contained. The oil proved harmless to castrates older than three days, and it had not any effect upon size or structure of the penis.

* The sample of Proviron used in these experiments contained small quantities of a cornifying hormone.; 0.5 mgm. of the substance contained at least one unit of oestrin.

Results

Macroscopic inspection of the genital region of the castrates to which proviron had been administered showed definite changes within three days after the first injection. The castrate's genital papilla is very small. In the injected castrates it enlarged considerably, sometimes within 48 hours after the injection. Three days after the injection it was larger than the papilla of the intact controls. From the fourteenth to seventeenth day onward considerable quantities of yellow secretion could be expressed from the ducts of the papillary glands.

Macroscopic inspection also showed that the opening of the sheath was slightly larger than in the intact controls. A small cartilage—which is entirely absent in the castrate—could be distinguished. No attempt was made to remove the glans from the dermal sheath; while the passive erigibility constitutes a significant sign of normal development, the test was omitted so as not to disrupt artificially any fusion between the integument of the glans and the epithelium lining the sheath.

The genital papilla continued to grow in the injected castrates; it equalled in size and appearance the sheath of the intact controls when the animals were killed at the age of three weeks.

Microscopical examination of the glans penis did not show any qualitative deficiencies such as result from castration. The differentiation of the integument was further advanced than in the intact controls. It contained papillae in advanced stages of development; they resembled those of animals aged five to six weeks, i.e. they were large and had a well-developed core. The fusion between the epithelial lining of the sheath and the integument of the glans which persists in the intact animal for some weeks after birth and is a permanent feature of the castrate's penis, was partly dissolved in the injected animals. The corpora cavernosa did not show any sign of the de-differentiation which occurs in the castrate. They were very rich in muscle fibres; the cavernae, largely contracted in the sections, contained but little blood. Accessory cavernous spaces were found, and the suburethral spongiosa was highly developed. (Plate III; fig. 10).

Quantitative statements cannot be made, save with certain reservations, in view of the small number of survivors. From the records it seems likely that certain characteristics which are open to quantitative examination fell somewhat below the normal standard; this applies, for instance, to the *number* of papillae even though the development of the individual papilla exceeded the normal.

No significant differences between the seminal vesicles of controls and experimentals respectively were detected. Microscopical examination also failed to detect any effect of the injections upon either epithelium or fibro-muscular wall.

Discussion.

The experiments under discussion show that the effects of castration can be largely neutralized by injections of androkinin. It seems reasonable to regard this result as a confirmation of conclusions drawn from the observations on castrates. It appears indeed that, in the rat, testicular function controls prepuberal as well as puberal development. Since prepuberal development consists largely of differentiation and not only of growth and activation, it must be assumed that androkinin can indeed act as a differentiating factor.

It is of some interest that the effects of androkinin vary quantitatively with the constituent of the penis. The number of papillae does not reach the normal standard; the development of the corpus cavernosum somewhat exceeds it. On the basis of general concepts of developmental mechanics, one would expect the effects of androkinin to vary quantitatively in inverse proportion to the determination rate of the respective reactors. Generally speaking, this expectation is realized, as will be seen when the data referred to above are compared with previous findings. But this theoretical relation is not realized in the case of the anterior process; the anlage of the latter is not determined at birth yet fails to reach the normal standard of development.*

The failure of secretory activity in the seminal vesicles may be regarded as a further indication of the relatively high "threshold" of these organs. At the same time it cannot be excluded that other factors such as the absence of accessory hormones may play a rôle.†

The experiments under discussion show that early development of the penis is conditioned by androkinin, but they do not prove that the injected substance is identical with the secretion, part or whole, of the testes of the rat.

On the other hand, the present experiments may be interpreted

* See, however, § vi, p. 921 *f.*, the development of a cartilage in females.

† Only a small quantity of proviron was available for these experiments, so that the threshold of the differentiating effect could not be determined. However, observations on two cases indicate that the quantity of proviron administered to the experimental animals was well in excess of the minimum effective amount.

as indicating that the hormone controlling early development in the male is either not different from, or else is very nearly related to, the factor that conditions the puberal activation of the genital organs of the male. It has been suggested by previous authors that the hormones secreted during, and responsible for, the development of the genital organs during the intra-uterine phase might be different from the factors ordinarily referred to as sex hormones (*"Sexualhormone der zweiten Stufe"*). The present experiments do not exclude this possibility, but they seem to make the accessory hypothesis involving existence of specific sex hormones active during the prepuberium unnecessary, at least so far as the male is concerned.

IV. The Post-natal Development of Uterus and Vagina.

Effects of Oöphorectomy.

The genital functions of the female have been the subject of numerous studies which have produced a great deal of important data. Yet in all this data there is a disappointing lack of information regarding the mechanism of prepuberal development.

Most authors concerned themselves with the mechanism of the sex cycle and the factors which cause puberty and maintain the active state of the genital system. It is, however, not possible to draw any definite conclusion from the facts relating to these phenomena. It has been shown, for instance, that the intricate changes of the sex cycle—the oestrous as well as the reproductive phase (pseudo or true pregnancy)—depend on ovarian function. But, in the first instance, these changes do not involve differentiation to any considerable extent (excepting cornification). The genital tract is fully differentiated when the first oestrous cycle (signifying puberty) occurs, and the action of the ovarian hormones which cause the changes of the sex cycle consists primarily in the activation and proliferation of tissues already fully evolved before the onset of puberty. Nor does oöphorectomy teach us anything of much value. The oestrous cycle remains in abeyance when the ovaries are removed unless their function be replaced by injections of ovarian extracts or equivalent substances. But it is again impossible to draw any valid inference from this observation with respect to the conditions of differentiation; for although uterus and vagina atrophy to some extent in the absence

of ovarian secretions, they do not undergo true de-differentiation* as far as our knowledge goes; even several months after castration the uterus of the rat still exhibits clearly marked zones of muscle and submucosa respectively.[22, 33]

Moreover, sex cycles are absent during the prepuberal phase of life. This phase is defined by the absence of cycles as much as puberty is defined by their first occurrence[34]; the physiology of the sex cycle can thus hardly be identical with the physiology of the prepuberium. In fact, it is generally accepted that ovarian function does not begin until puberty, at which it manifests itself in cornification of the vaginal epithelium and a short preceding phase of mucification.[13] Thus some authorities are inclined to regard puberty as marking the inception of gonadic function in the female while, on the the other hand, it is assumed with almost equal assurance that female differentiation proceeds under the influence of, and is dependent on, secretions of the ovary. It is astonishing that this contradiction could not only persist in the literature without being subjected to experimental examination, but could even be expressed by one and the same author.

The rat, however, constitutes a suitable animal on which to study the problem of prepuberal differentiation. The effects of oöphorectomy performed in the newborn female were therefore studied in a number of females by the present writer.[4, 5] But since, at that time, a method was not available which would not permit the absence of ovarian tissue to be established, the experiments were repeated on rats of the Wistar stock.

Methods.

(*a*) Operation. The general technique was the same as that applied in males. The lateral approach was used for oöphorectomy. The ovaries were removed together with the tubes and the tip of the uterine horns. Ligatures were not applied.

(*b*) The question whether oöphorectomy was complete is not so easy to decide as the corresponding problem in males. In the latter, the gonad represents a well demarcated and comparatively large organ even in the newborn animal, and inspection of the testicle after removal shows whether the tunica has been injured (so that parenchyma may escape and remain in the body) or

* It has, however, been stated that prepuberal castration is followed, in the mouse, by a pronounced involution of the uterus involving dedifferentiation of the epithelium and the muscle layer (Parkes).[33] This striking effect will require further studies.

whether castration was complete. Moreover, the observations on the male have established differences between intact and gonadectomized animals respectively, whereas in the female it appeared that the development is frequently identical in oöphorectomized and normal animals respectively—a finding more difficult to establish. Last, but not least, it has been stated by previous authors that regeneration of the ovary may occur,[35, 36, 37, 38] and one had to consider the possibility that the experimental animals, though completely spayed at birth, regained some measure of restitution of ovarian residues or reserves, so that the development of the genital organs proceeded in reality under the influence of an ovary.

All these possibilities can probably be excluded in virtue of a precaution which was taken in most experiments. It is well known that ovarian function depends on the presence of gonadotropic hormones. Injection of gonadotropic extracts induces excessive follicular maturation and/or luteinzation and, indirectly, growth of the uterus.*

The experimental animals (oöphorectomized at birth and intact controls) were therefore subjected to administration of such extracts (prepared by a method published elsewhere),[39] since one could expect that any ovarian residue or restituted ovarian tissue would hypertrophy in the manner so frequently demonstrated, and thus be easily detected. Moreover, such stimulated ovarian tissue would not only betray its presence by its morphogenetic development, but also by its physiological action, since it would secrete ovarian hormones and thus call forth the phenomena of oestrus or pseudo-pregnancy. This assumption was first tested and found to be correct in seven cases in which oöphorectomy (at birth) had been deliberately faulty.†

The following procedure was adopted: When it was desired to examine the experimental animals and controls, one horn of the uterus was removed for histological purposes. The animals were permitted to recover, and received, after a short interval, one injection daily for six days of a urine-extract containing gonadotropic hormones combined with a small quantity of anterior lobe extract. The total quantity of extract administered to each animal amounted to about 40 luteinizing mouse-units, though this figure can only be regarded as an approximation, standardization of these extracts being difficult. The animals

*This does not apply to all extracts and all dosages.

†The ovaries were "mutilated," not removed, at birth.

were killed on the fifth or sixth day after the first injection and examined for ovarian residues and signs of ovarian secretion. A pronounced ovarian, uterine and vaginal effect of the extracts was found in all controls (which, of course, had remained intact or else had been submitted to unilateral oöphorectomy). On the other hand, in none of the experimental animals was any ovarian tissue found; nor did the uterus, or the vagina, of the supposedly oöphorectomized animals show any influence.

(*c*) It proved difficult to carry out quantitative comparisons between the uteri and vaginae of intact and oöphorectomized animals respectively by simple inspection. The uterine wall of the rat is differentiated in three layers consisting of muscle and submucosa respectively. Cross-sections through the uterus are frequently of complex structure due to the presence of glands, and direct comparison of the areas of two sections does not yield quantitative indices. Moreover, the thickness of the wall and the area of the lumen vary even with the same uterus, and the respective thickness of muscle and submucosa may differ even in closely adjacent regions. The weight of the genital tracts could not be regarded as an appropriate basis of comparison of experimental and control animals, since part of the uterine horns of the former had been removed. Indirect planimetry was thus applied, a number (10 to 30) of sections through the tract being drawn and weighed (see below). The "diameters" of uteri shown in Table II refer to such planimetric determination. The uterus is frequently of elliptical shape, particularly in very young animals; the figures given as diameter are calculated, however, as if all uteri were cylindrical in shape. Submucosa and muscle zones were measured separately. The planimetric indices of each uterus can be regarded as a group and their respective statistics can be compared in the usual way.

The same method was applied to the vagina. But in this case it was impossible to draw comparisons between oöphorectomized and intact litter sisters, since the latter had been subjected, in most cases, to the action of ovarian hormone secreted in consequence of the administration of gonadotropic hormones. Thus the vaginae of intact litter mates were already matured. Controls from other litters had, therefore, to be used.

Normal Development During the Prepuberium.

The newborn female is readily recognized as such, the anogenital distance being very short; nipples can be easily distinguished, while they are absent in the male. Of other sex

TABLE II.

Litter No.	Animal No.	Operation	Age at death	Mean diameter of uterus	Mean height of uterine epithelium	Mean height of vaginal epithelium	Maximum dorso-ventral diameter of clitoris
			days	mm.	μ	μ	mm.
549	3	oo	28	·61	11	14	1·3
	4	o	28	·64	12	16	1·2
608	1	i	21	·61	11	15	1·1
	6	oo	21	·56	11	13	1·1
580	2	i	24	·58	13	17	1·3
	3	i	24	·53	14	14	1·4
	4	oo	24	·57	12	17	1·4
715	3	o	21	·61	11	15	1·4
	5	i	21	·58	12	15	1·4
	7	oo	21	·58	11	13	1·4
861	4	oo	11	·42		15	1·1
	5	o	11	·40	12	14	1·0
	6	i	11	·41	12	15	1·0
997	3	oo	39	·67	11	14	0·9
(*)	1	oo	27	·56	11	18	1·2
	2	oo	27	·52	11	16	1·4
	3	i	27	·57	13	—	1·3
1299	1	c	17	·56	11	14	1·2
	2	oo	17	·51	11	13	1·1
	3	oo	17	·55	11	13	—
1180	1	c	40	·71	13	17	1·4
	2	oo	40	·70	11	13	1·6

(*) Foster litter

i—intact control
oo—bilateral oöphorectomy
o—unilateral oöphorectomy
c—control operation (laparotomy).

Measures of clitoris and vaginal epithelium given for control animals were actually obtained from other animals of equal age and approximately equal body-weight. See page 899.

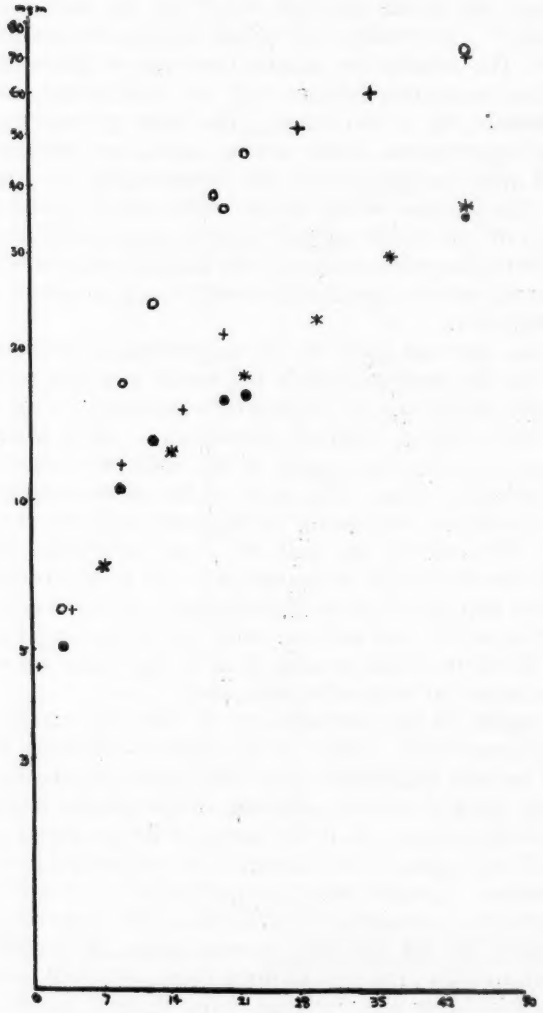
differences the lower average weight of the female may be mentioned.[12] Internally, all typical female organs are easily identified. The ovaries are minute (average weight 0.92 mgm.), but contain numerous follicles and are enshrouded, as in the mature female, by a thin bursa. The tubes present the typical coiled-up appearance; both uterine horns are developed and equipped with vessels (though the blood-supply is exceedingly small). The vagina—which has no orifice but is closed by a cell plug, as in the pubescent animal—is very narrow but comparable, with respect to its gross anatomy, with that of much older females. In one word, macroscopical inspection reveals an advanced stage of differentiation.

But this does not apply to the microscopical structure of the uterus. In the newborn female the uterus is found to be of an exceedingly simple, in fact, embryonic structure. The lumen is narrow and elliptical without diverticula. It is lined by an epithelium of an average height of 8μ, while the nuclei have an average height of 5.5μ. The walls of the uterus do not exhibit any differentiation whatsoever in the great majority of newborn females. The cells of the wall are of an embryonic character, differentiation in muscle or stroma cells not being apparent. In many cases two zones can be distinguished—an outer zone, which is poorer in nuclei, and an inner zone where the nuclei are more densely distributed and rounder than in the outer zone; in the latter the nuclei are somewhat elongated.

The vagina of the newborn rat is, like the uterus, incompletely differentiated. There is no vaginal orificium; the latter does not become established, as a rule, until very shortly before, or during, the first oestrus, although differentiation is completed several weeks earlier. As to the lumen of the proximal (cervical) portion of the vagina, it was found to be established in seven out of 11 newborn animals which were examined. It was lined by a low epithelium consisting of a matrix of the same character as is exhibited by the stratum germinativum of prepuberal or pubescent animals, and two to three layers of small cubic cells; the superficial layer was, in some cases, slightly vacuolated.

In four animals no vaginal lumen was found even in the *pars proximalis** of the vagina. In place of the lumen a mass of highly vacuolated cells with small darkly-staining nuclei was spread between—and had apparently originated from—the

*i.e., the two diverticula which lie on either side of the two cervical portions of the uterine tubes; the latter do not merge, in the rat, into a common corpus.



Age in days.

FIG. 3.

Growth of Genital Tract in Female. [*Arithlog grid.*]

* Hatai's graduation of body-weights.
• Mean body-weights; writer's specimen.
o Mean weight of genital tract; writer's specimen.
\+ Mean weight of genital tract; Osterud's specimen.[12]

As in FIG. 1 and 2 body-weights have been reduced to a comparable scale.

epithelium proper which was not clearly demarcated. The epithelium itself was in a very early stage of development, did not show a distinct basement membrane, and was of an embryonic character.

The epithelial lining of the vagina of the newborn animal shows but very few of the folds characteristic for later stages of development. The vaginal wall is incompletely differentiated. Muscle fibres are absent, and the peripheral layers consist of embryonic cells with elongated nuclei.

During the first fortnight post-partum intensive growth of the genital tract and of the ovary takes place. The tract grows in positive heterogony to the organism as a whole during this period, after which both absolute and relative growth-rate are reduced considerably. For actual data the reader is referred to Fig. 3 and Table II. The growth of the uterus is connected with a very pronounced increase in vascularization. While the uterus of the newborn female is a pale transparent organ in which but few vessels can be distinguished under the binocular microscope, the uterus of the pubescent female is rich in small vessels.

The growth in size exhibited by uterus and vagina during the earliest period of extra-uterine life is very pronounced, but is perhaps of minor importance compared with the processes of differentiation. The latter consist, in the vagina, mainly of the formation of the muscular wall out of the embryonic tela found in the newborn. Also, the inter-epithelial cell-accumulations largely disappear so that the lumen of the vagina becomes free and more voluminous. In the case of the uterus, differentiation is much more pronounced. The embryonic character of the uterus disappears within the first week of extra-uterine life. Two layers of muscle cells form; an outer zone, where bundles of longitudinal fibres are found, and an inner one where circular fibres form a ring around the submucosa. The epithelium of the lumen assumes a columnar character and diverticulates slowly but continuously. During the first three weeks of life the simple elliptical shape of the lumen is thus replaced by a more complex one, while glands develop and variegate the appearance of cross-sections of the submucosa. Through these processes of differentiation the uterus attains the character of the pubescent organ which differs from the mature organ mainly in size and the degree and character of cellular activity. An embryonic tube is found in the newborn rat. Less than three weeks later its place has been taken by a fully differentiated organ, highly complex with its muscle layers and submucosa and glands. (Plates III, IV.)

It must be understood that the process of development continues between the twenty-first day of life and puberty; the number of muscle fibres increases, the glands continue to proliferate, and the submucosa increases in thickness. But the essential process of differentiation, which creates the muscular wall and the submucosa out of the undifferentiated uterus of the newborn female, is completed, with respect to all its essential features, when the animal still suckles, although differentiation becomes manifest only after birth. Processes of differentiation during infancy are not restricted to the genital tract but occur also in the clitoris.

In the rat, as in other rodents, the vulva is not developed; there is no common superficial orifice of the genital and urinary canal respectively. The former terminates with the vagina; the latter leads into a fossa opening upon the apex of a dermal sac which encloses the clitoris and corresponds to the dermal sac enshrouding the glans penis.*

Cross-sections through the apical portion of this sac show that its lumen is largely filled by loose connective tissue surrounding (*a*) the efferent ducts of two greatly developed sebaceous glands, and (*b*) a fossa into which opens the terminal portion of the urethra. The latter is accompanied by cavernous tissue which is but slightly developed.

To find the glans clitoridis proper one has to search nearer the base of the dermal sac.—When the latter is opened by a longitudinal incision, the glans clitoridis can be easily seen. It constitutes a small pale organ comparable in shape with the glans penis of the very young castrated male. Cross-sections reveal that the glans clitoridis consists of two sharply demarcated elements.

Ventrally, there lies the urethra. Its epithelium is five to seven layers high and is built up by round, indifferent cells which are transformed, in the distal region, into squamous cells. The epithelium is thrown up in folds so that several diverticula of the main lumen are formed; in some instances such diverticula may grow in ventral and proximal direction, so that, on superficial inspection of cross-sections, two separate urinary ducts seem to be present. The urethra is surrounded by its spongiose body; the fibro-muscular parenchyma of the latter encloses narrow irregular cavernae. In 11 healthy mature females these cavernae were invariably filled with blood. There is no sharp demarcation

*Drahn failed to find the clitoris and makes the erroneous statement that it is represented by the fossa mentioned above. Parkes, however, shows a photograph of a section through the clitoris of the mouse.

between the corpus urethrae and the fibro-muscular wall of the vagina; the two outer zones show continuous transition.

Dorsally there is found the corpus cavernosum clitoridis. Its anterior (apical) portion is covered by an epithelium which represents a continuation of the epithelial lining of the dermal sac. The transition is effected by a half-circular plica situated approximately in the median zone of the corpus cavernosum. This integumental epithelium is incompletely stratified in the apical region and smooth in the posterior zone; it is permanently fused with the lining of the dermal sac—in the same way as the glans penis of the immature male. The integument is variegated by very few papillae; they are not complicated structures like the papillae (thorns) of the mature glans penis, but represent simple "nodules" of the integument.

The structure of the corpus cavernosum is determined by fibro-muscular trabeculae; they are arranged irregularly and surround round cavernae mostly of very small diameter. Two larger cavernae are found in the ventral region of the corpus cavernosum; they lie just above the dorsal wall of the urethra.

In comparing the clitoris with the penis, it is thus noted that the structure of the female organ is comparatively simple. The differences are, to some extent, quantitative. The corpus cavernosum of the glans penis surrounds the urinary canal, once development is completed. In the female, the cavernous body is restricted to the dorsal region of the urinary canal. It is perhaps not quite correct, therefore, to state (as some authors have done) that the urethra of the female rat penetrates the clitoris. Another quantitative difference is that of size.

Qualitative differences are of equal or greater importance; the absence, in the female, of an os penis or a cartilaginous process has to be emphasized in view of certain observations to be discussed later; the same applies to the absence of papillae, the persistence of the fusion between the integument and the lining of the dermal sac respectively, and the low degree of differentiation in the corpus cavernosum of the clitoris.

The clitoris of the newborn rat corresponds to that of the penis at the equivalent age. The corpus cavernosum of the clitoris shows no cavernae before the third week post-partum; its parenchyma consists of embryonic cells. On the other hand, differentiation is completed within about three weeks and the clitoris of the immature female differs but little from that of the mature animal, except for size.

EFFECTS OF OÖPHORECTOMY.

Thirty-four animals on which bilateral oöphorectomy had been performed before they were more than 12 hours old survived for more than 11 days. The general effects of the operation were marked for several days, but disappeared gradually in most instances. Mortality was much higher than in males. Parts of the uterine tubes were removed at various ages (11 to 74 days), but mostly during the fourth week of life. In 25 animals absence of active ovarian tissue was established by the method described; in nine cases the method was not applied.

Macroscopically, no difference between controls (not subjected to the action of gonadotropic hormones) and oöphorectomized females was detected in 23 cases except for the somewhat shorter uterine horns, part of which had been removed at the original operation. In six cases the uteri of the oöphorectomized animals appeared to be thinner than normal. In four cases small abscesses were found in the ovarian region, the genital tract being otherwise of normal appearance. In one case (age 74 days) puberty had supervened in the control animal and the genital tract of the experimental animal was markedly thinner than that of the control female.

The diameter of the uterus was calculated as described before in 29 cases, including five cases of manifest under-development. Some data are reproduced in Table II. It appears that the uterus of the oöphorectomized animals is, in most instances, of about the same diameter as that of the control females (unilaterally oöphorectomized or entire). Deviations in either direction appear, but are, as a rule, of insignificant magnitude.

On histological examination of the uteri gross deviations from the normal were not detected in 28 cases; that is to say, the uteri in question were fully differentiated into two muscle layers and a submucosa. Smaller deviations appeared in some cases; they relate to the degree of development exhibited by the musculature and to the number of glands (in the older animals). These smaller deviations are difficult to establish accurately and may be neglected since they appeared in both directions. In five cases the oöphorectomized prepuberal animals were found to have under-developed uteri, not only with respect to size, but also with respect to differentiation, muscle cells being comparatively scarce.

The thickness of the muscle zones and the submucosa of the uteri of controls and experimental animals respectively was determined in 29 cases and differed but insignificantly in 21 cases;

this statement refers, as explained above, to the uterine horn as a whole, not to any single pair of sections. Two sets of the actual planimetric indices are reproduced in Table III. In eight

TABLE III.

Planimetric Indices of Uteri.

(1) R. 1299–1 (entire)		(2) R. 1299–2 (oöphorectomized)	
Submucosa	Musculature	Submucosa	Musculature
33·5	41·5	35·5	41·0
41·5	39·5	30·5	39·5
32·0	32·5	51·5	34·5
36·0	34·0	34·0	31·5
33·0	37·5	30·0	35·0
36·0	31·5	32·0	42·5
36·5	36·5	47·0	45·5
34·5	39·0	32·5	35·5
55·0	59·0	34·5	43·5

cases significant differences were established; in five of these (see above) both muscle layers and submucosa were thin; in three the submucosa was thicker than the corresponding zone in the control animals, while the muscle zone was considerably thinner. The development of the vagina proceeded, in the experimental animals, without any detectable disturbance. Neither qualitative nor significant quantitative differences between controls and experimental animals were detected in 24 cases; in five cases in which the uterus was under-developed the vaginal wall was thinner than in the controls. The same applies to four cases in which uterine development was normal and to one case in which the control animal had passed the first oestrous cycle.

The clitoris was sectioned in 17 cases. Deviation from the normal development was not detected.

It appears to be probable that oöphorectomy in the experimental animals was complete, since ovarian tissue or effects of ovarian hormone were not detected in any animal. This fact in itself would not eliminate the possibility of ovarian tissue being present in the females killed at a very early age; for the very young rat does not react clearly, or reacts not at all, to gonadotropic hormones. But after the third week the ovarian reaction is strong, and it seems probable that those animals which were killed before the age of 21 days were as completely oöphorectomized as those sacrificed at a later age.

In the rat, the ovary is the only known source of thelykinins;

even the placenta, which in some other species contains large quantities of cornifying hormone, appears to lack this factor. Retention of ovarian hormone in the circulation seems unlikely in view of the rate at which cornifying hormone is excreted or destroyed, and the rapidity with which the phenomena of oöphorectomy develop in the puberal female. It would seem, therefore, that the experimental animals in which complete oöphorectomy was performed very shortly after birth, continued their development in the absence of ovarian secretion.

Yet the data show that impairment of prepuberal development occurred only in five animals, whereas the remaining animals did not differ significantly from the normal. Prepuberal development of the genital organs thus appears to be independent of ovarian hormones. This development involves considerable growth as well as intensive differentiation. It is equivalent to the development occurring in the male during the first weeks post-partum; but in contradistinction to the male, the gonad is not required, in the female, for prepuberal development.

This conclusion appears not to be invalidated by the partial inhibition of development that occurred in five cases. The uterus of the rat receives its blood-supply from two arteries; one enters the mesometrium at the tip of the uterus while the other supplies the cervical and corporeal portion. The former is destroyed by the operation so that interference with the blood-supply should result. It is possible that this interference, together with the general disturbance of the operation, may lead to developmental retardation in some cases. However, cases of undisturbed development are not only more numerous, but also of greater consequence.

It would appear, therefore, that somatic, and not gonadic, factors, are responsible for early genital development. An opinion cannot be expressed, on the basis of facts, as to whether these factors are part of the genetical constitution of the cells forming the genital organs; or whether specific extra-cellular factors are required to secure genital development. Such extra-cellular factors may be represented by ovarian hormones secreted during intra-uterine development; or they may be non-gonadic in nature.

It need hardly be emphasized that independence of female differentiation is a phenomenon restricted to the early phase of extra-uterine development. It is well known that prepuberal oöphorectomy inhibits puberal development so that the conditions of immaturity persist. While the early removal of the ovary

does not interfere with the further differentiation of clitoris, vagina and uterus, it does prevent the activation of these organs and eliminates the impulse to growth normally manifested as puberty. In other words, oöphorectomy does not interfere with differentiation but prevents maturation.

It seems necessary, therefore, to distinguish, in the female, between two phases of extra-uterine genital development. The first phase is represented by infancy, during which differentiation of the genital organs is completed; the second phase is represented by puberty, when the effect of ovarian hormone becomes manifest. Puberty in the female appears, therefore, to be a much more distinct phenomenon than in the male, where it simply represents an intensification of processes which are in progress during the whole of the extra-uterine life.

It is difficult to say at what time differences between the intact animal and litter sisters oöphorectomized at birth become apparent. In the mouse it has been shown[13] that certain effects of ovarian secretion (mucification) can be demonstrated several days in advance of the first occurrence of cornification, which may legitimately be regarded as the most significant indication of ovarian function. Prepuberal mucification can be reproduced by the injection of about one-half of the cornifying unit of follicular juice or purified urine preparation,[14] and it may be concluded that this phenomenon is due, in the intact female, to a low-level secretion of cornifying hormone, although it may also be determined by other factors. Uterine development preceding prepuberium may also depend on ovarian secretion. Uterine development during the days immediately preceding puberty may possibly depend on ovarian secretion. But one may regard this as highly improbable since uterine effects (of the oestrous or pro-oestrous type) demand for their occurrence several units of cornifying hormone*—whereas the actual secretion probably corresponds to less than the unit since it produces only mucification.

*A note may be appended as to the reaction of the uterus and vagina of oöphorectomized females. When three females were injected with large quantities of cornifying hormone (about 200 units) at the age of three weeks, uterine development and vaginal cornification ensued. This shows that reactivity to cornifying hormone develops in the oöphorectomized as in the normal intact female, and does not demand the previous secretion of a sensitizing substance by the ovary—a possibility which could not safely be neglected in view of other findings.

V. The Effects of Thelykinin in Newborn Females.

The effects of thelykinin upon the genital organs of the immature (pubescent) female are very striking, as is generally known. It may be recalled, in particular, that the most pronounced effect is represented by the enlargement of the whole genital tract. Thelykinin causes intensification of mitosis, particularly in the epithelial lining of the vagina; it also activates the secretory function of the uterine epithelium.[40] Morphic effects involving differentiation are less prominent, but by no means absent. The cornification occurring in the vaginal epithelium represents one such effect; another is seen in the uterine epithelium of the pubescent uterus. The latter is lined by an epithelium of almost embryonic appearance. Under the influence of thelykinin this epithelium assumes columnar character and undergoes activation, as has already been mentioned. As to the wall of the pubescent uterus, it should be remembered that at the end of the first weeks of life uterine differentiation is already fairly far advanced, muscle cells having developed during the first days following birth. When injected in prepuberal animals, thelykinin already meets with a differentiated uterus; it is not, therefore, quite appropriate to state that theelin effects differentiation of a muscular zone.[41]

One must again lay emphasis on the fact that the extensive studies relating to the action of thelykinin upon the uterus of the pubescent female are concerned with the effect of the hormone upon a structure already previously differentiated. The question arises whether thelykinin is capable of influencing the process of differentiation itself. The rat is a species in which this question can be studied with comparative facility, since the uterus is not fully differentiated at birth.

Allen and his collaborators made the first relevant contribution to the problem.[42] They injected oily solutions containing theelin in pregnant rats. The medium was stained with Sudan III so that its passage through the placenta could be ascertained. Yet the genital tract of the foetus did not show any detectable influence of the hormone; it appeared to be of normal size. However, the passage of the dye does not, of course, absolutely prove that the hormone was transported with the dye; and a repetition of the experiment under stricter precautions seemed appropriate. Parkes and Bellerby[43] remark that small doses of oestrin do not affect the genital tract of the newborn animal.

Wiesner[5] also failed to find cornification or uterine enlarge-

ment in newborn females injected with several units of ovarian extracts.

These experiments were repeated and extended. In the first series of experiments foetûs were injected with ketohydroxy-oestrin solutions; these experiments will be reported separately. In addition, a number of females were injected from birth onward, receiving varying amounts of ketohydroxy-oestrin for periods ranging from two to five days. Thirty-four animals survived. The results being uniform, only three experiments need be described.

In all instances the strongest females of the chosen litters were selected for treatment; one injection was given daily. The animals were killed by decapitation, the genital tract was prepared at once and weighed in the fixation fluid (formol saline) together with the ovaries and tubes.

(*a*) Some females received injections of ketohydroxy-oestrin, samples of which were obtained from the British Drug Houses. The substance was administered in aqueous alcohol, oil being unsuitable because of very slow absorption. By using alcoholic solutions the volume of the injections can be kept very small; small necrotic areas appear, but do not interfere with the general development of the animal.

(*a*) (i) Five females which had received three injections were killed on the third day. The total amount of hormone administered was 0.0005 mgm. The average weight of the genital tract was slightly lower than the corresponding measure established in four intact females; the difference is hardly significant. (Fig. 4). Microscopically, differences between controls and experimental animals could not be found. There was not any enlargement of the vagina or the uterus, or trace of epithelial proliferation and no enlargement of the clitoris (which was inspected under the binocular).

(*a*) (ii) Three animals survived of the group which had received a total of 0.0085 mgm. ketohydroxoestrin; they were killed on the sixth day. Uterine enlargement, if present, was too slight to be noted; cornification had not occurred and the vaginal epithelium was not even proliferated. Advance in the differentiation of the uterine wall was not noted.

(*b*) (i) Four animals survived in the group which had received 100 international units of menformon daily (aqueous solution). They were killed on the fourth day (total amount injected 0.3 cc. equalling 300 international units). Not any effect was noticed when the specimens were weighed and examined microscopically.

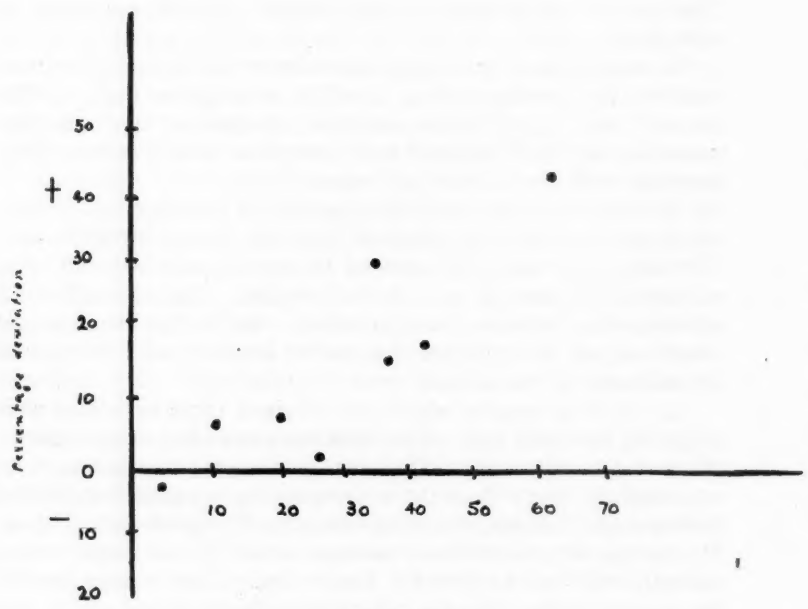


FIG. 4.

Effects of Injection of Ketohydroxy-oestrin on the Weight of the Genital Tract.

Weights of genital tracts shown as percentage-deviation from control-weights.

(*b*) (ii) Three animals survived of the group which had received three injections of menformon, totalling 0.6 cc. (=600 units). They were killed on the fourth day. The injected fluid had not been absorbed completely.

There was a slight heightening of the vaginal and uterine epithelium; the uterus did not show any general advance in differentiation. The narrow muscle layer which, at this age, had begun to differentiate, stained more darkly with haematoxylin than the corresponding zone in the controls. As to increase in size, it appeared from inspection of the fixed specimens that the uteri of the injected animals were slightly enlarged. Indirect planimetry was, therefore, applied to the uteri of the experimental animals and to the uteri of four control females. Regarding the indices obtained for the control animals as a single sample and the indices of each pair of experimental uteri as separate groups, it was found that in one case the differences between the means of the planimetric indices was insignificant; in one case it was of doubtful significance; in one case it was undoubtedly significant. On the assumption that the planimetric indices referred to circles—the uterus, in reality, is of elliptic rather than circular shape in the very young rat—an increase of 7.1 per cent in the diameter of the experimental uteri was calculated. Table IV gives examples of indices. (Cf. Plate IV.)

TABLE IV.

Planimetric Indices.

Injected animal	Control animal
4.2	3.0
5.0	3.6
4.5	3.7
4.6	3.6
4.5	3.6
4.0	
4.7	4.2
4.0	3.0
	3.0
4.0	2.9
3.7	2.8
3.7	2.8
3.0	3.5
3.0	3.5
2.8	3.4
	3.5
	2.8
A.M. = 3.98	A.M. = 3.31

(*c*) Three animals survived of a group which had received five injections of ketohydroxy-oestrin solution and were killed on the sixth day, a total of one milligramme having been administered to each animal. The vagina was closed. The genital papilla was not enlarged. The uteri and vaginae appeared to be slightly enlarged; their average weight was 17.3 mgm. Microscopically, it was also found that the uterine tube had increased in size though considerable variation was observed. On the assumption that the uterus is cylindrical in shape, diameters varying from 0.37 to 0.40 were calculated for the experimental uteri; the corresponding figures for the controls vary from 0.31 to 0.38. The uterine epithelium was columnar and in some regions reached a height of about 30μ. The uterine tubes were not distended. Glands had not formed. The wall of the uterus showed a muscle zone slightly broader and more distinct than that seen in the controls. The vaginal epithelium was considerably higher than in the controls and attained a height of 65μ. It was somewhat granulated but not stratified. The superficial layer showed slight vacuolization.

In addition to these experiments seven animals were injected with varying quantities of menformon and ketohydroxy-oestrin respectively, and were killed on the third day. The maximum amount of hormone administered was 0.001 mgm. of ketohydroxy-oestrin and 25 units of menformon respectively. Not any effect was noticeable in these animals.

It appears, therefore, that the effect of even large doses—omitting, for the moment, the experiments with excessive doses (1 mgm. of oestrin)—is negligible. Doses to which the pubescent female reacts with cornification and uterine enlargement resulting in the well-known oestrous distention of the uterus fail to produce a detectable effect upon the vagina and the uterus. When large doses are applied, amounting to several hundred times the unit dose, a slight enlargement of the uterus and possibly the vagina results. But there is no distinct evidence of acceleration of differentiation. The latter might manifest itself in two ways, (*a*) by the occurrence of cornification in the vagina and the formation of vaginal recesses (folds); (*b*) by the accelerated formation of the muscle layers and glands seen in the uterus of the pubescent female.

As to (*a*) the vagina failed to show the effect in question even with excessive doses. As to (*b*) it is hardly possible to conclude that the differentiation of muscle layers had been advanced, although the respective zones were more clearly demarcated in

some experimental animals. It has to be considered that, normally, muscle cells form even in the very young rat, and it seems that the muscle cells which had already formed responded, in some degree, to the injections.

As to excessive doses it was noted that the epithelium of the vagina responded in some measure to the injection while it did not show the typical effect of oestrin. This may be taken as indicating an incapacity of the very young vaginal epithelium to undergo the process of differentiation. As to the uterus, the slight increase in the diameter of the muscle zones and the better demarcation of the latter might be regarded as an indication of advanced differentiation. Yet it is more than doubtful whether this view is appropriate. It may be repeated that muscle cells are already formed during the first day of post-natal growth, and it is also known that muscular development occurs in the uterus of the pubescent rat under the influence of the hormone. The results can be reconciled with the assumption that the muscle cells which were forming independently of hormone responded to the administration of the latter; for the embryonic character of many cells of the uterine wall was not altered by the injections; this applies particularly to the zone which, later in development, gives rise to the longitudinal fibres. In other words, it appears probable that the muscle layers behave like the epithelium. The latter is not formed under the influence of hormone but responds to the excessive doses of the latter with distinct increase in height and assumption of columnar character. Further support to this view is represented by the absence of glands. These are not formed normally till later in development and were absent even in the animals injected with large or small doses.

The contrast between the effect of thelykinin in pubescent and newborn females respectively is striking enough to dispense with an extended discussion. On the one hand, a definite reactivity is not exhibited towards physiological doses or their multiple within the first few days of life and it is apparently only about the fifth day of life that distinct signs of hormonic action can be detected. Even then they are not very intense, occur only after large doses of the hormone and appear (so far as the present experiments show) to be restricted to growth rather than differentiation—i.e. the transformation of embryonic into specific cells. In the pubescent animal on the other hand, 36 hours are sufficient, and small quantities of the hormone are adequate to produce distinct, though not maximal, effects of the hormone.

It seemed of interest to examine, to some extent, the inter-

mediate phases of development. Such an examination was undertaken in a few experiments which showed that reactivity to thelykinin develops gradually during the first 14 days of extra-uterine life. When speaking of reactivity it must, of course, be borne in mind that two distinctions are necessary. In the first instance, the maximal reaction of the genital system has to be established; this can be attained by injecting very large quantities of the hormone. Secondly, it is necessary to define the threshold of the amount of hormone which will produce a distinct effect whatever its nature. In addition to these two contradistinct questions there arises an added complication through the differential threshold of the various constituents of the genital tract.

The extensive work on the standardization of the female hormones has revealed the complexity of the problems involved. Numerous factors have to be considered.[44, 45, 46] There are pronounced individual variations; the mode of administration of the hormone, the solution employed and many other factors play a very considerable rôle in determining the intensity of the ultimate effect. A complete analysis of the development of reactivity would have to meet all these difficulties and thus demand much more time and much greater resources than could be expended by the writer. However, some relevant data were collected.

Seven sets of rats were used. Each set consisted of several age-groups and each age-group of two to five animals. These animals received two to four injections of ketohydroxy-oestrin or menformon (aqueous solution)—one injection daily—and were killed three to five days after the first injection. The genital tract was prepared as a whole and weighed in formal saline. The ovaries were not removed.

In the first experiment .0005 mgm. of ketohydroxy-oestrin was administered to each animal. Five newborn females were used (see p. 911) in addition to the following females:—Three aged eight days, three aged 17 days, two aged 21 days, five aged 33 days, three aged 35 days, three aged 41 days, and four aged 60 days. The weights of the genital tracts of the experimental animals are shown in Fig. 4 where the averages are entered as percentage deviations from the normal weights. It appears that a significant deviation did not occur before the third week of life (when growth, at the dose employed, is particularly manifest in the vagina) and that the percentage increase rises with the age of the animal. It should be noted that the measurements are entered with respect to age at *death*.

In the second experiment to be related here, each animal re-

ceived daily injections (once daily, 200 units aqueous menformon per injection) (total 400 international units). The animals, three in each group, were killed on the fourth day, about 72 hours after the first injection. Fig. 5A shows the mean weights of the genital tracts of the experimental animals and the controls (two females per group. In Fig. 5B the same data are presented; the percentage deviation of the weights of the genital tracts of the experimental animals is shown (*a*) on an arithmetic scale (dots), and (*b*) on a logarithmic scale (crosses connected by line). The data indicate a pronounced increase in reactivity during the early post-natal period; the arrangement of the data on a logarithmic scale indicates that the rate of development of reactivity remains fairly high, but is insufficient to permit definite conclusions.

In a third experiment to be related here each animal received three injections of 0.2 cc. of menformon (total 600 units). The animals were killed on the fourth day after the first injection. The following females were used: Three newborn, three eight days old, three 12 days old, three 21 days old, three 30 days old. Again it is found that the response as measured by weight (Fig. 6) (averages entered in chart with references to age at death) increases with the age of the animal; however, comparison of the graphs shows that reactivity varies very considerably and was, in the third group, lower than in the second.

With intermediate doses it is also found that a very slight reactivity in the newborn and very young female is replaced by pronounced reactivity at the later stage. The data are, however, not produced here, since they do not contribute much to the detailed knowledge of the development of reactivity. As far as the present problem is concerned, it may be concluded, however, that reactivity to ovarian hormone does not emerge suddenly, but develops gradually.

If the process of uterine differentiation is related to the increase in reactivity, it will be seen that reactivity becomes pronounced during the third week of life—that is, the period of life at which differentiation of the uterine wall is approaching its prepuberal maximum.

The results of the experiments reviewed in the preceding paragraphs can be briefly summarized in the following statement. Physiological doses of thelykinin do not accelerate post-natal differentiation of the genital tract and their effects do not appear until a certain degree of differentiation has already been reached by both vagina and uterus. In some respects the behaviour of the genital tract towards this ovarian hormone resembles the be-

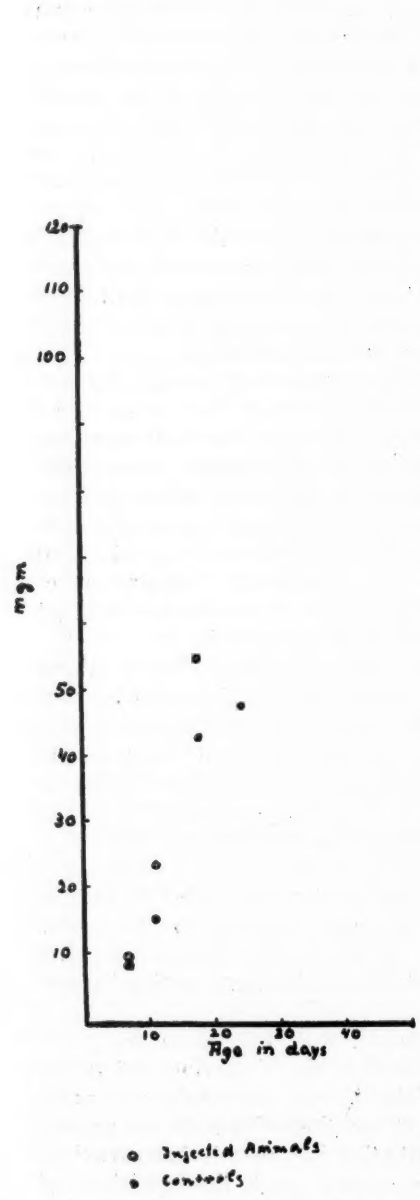

mgm
120
110
100
50
40
30
20
10
10
20
30
40
Age in days
Injected Animals
Controls

FIG. 5A.

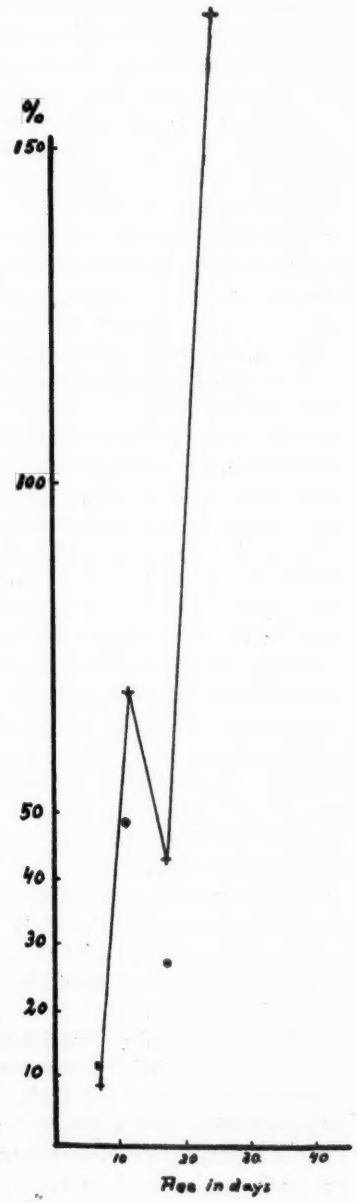

%
150
100
50
40
30
20
10
10
20
30
40
Age in days

FIG. 5B.

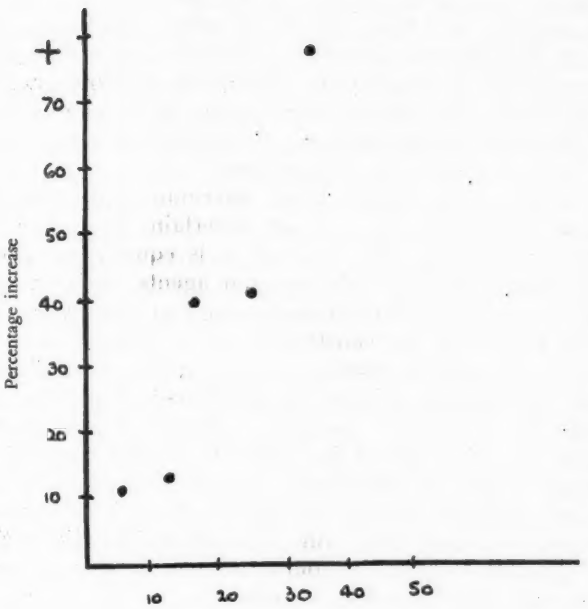


FIG. 6.

Figs. 5A, 5B, and 6. *Effects of Kethohydroxy-oestrin on the Weight of the Genital Tract.*

Fig. 5A. Ordinate shows weight of genital tract in milligrams; Fig. 5B. Ordinate shows percentage increase of the weight of the genital tract in injected animals.

For further explanations, see text.

haviour of the ovary towards gonadotropic hormones. The last-named hormones, which are produced by the anterior lobes of the pituitary body, induce ovulation and luteinization in the pubescent ovary and incite secretion of ovarian hormones. Their purification has been effected by various means, and preparations of a very high potency are available. It is found, however, that even a high multiple of a dose which will effect maturation of the pubescent ovary remains without typical effect upon the ovary of the newborn rat.[47] Reactivity of the ovary develops gradually; while the details of this development remain still to be investigated, the parallel between development of reactivity of the ovary and of the uterus respectively is suggestive.

The nature of the factors which determine ovarian reactivity to gonadotropic hormones is as yet uncertain. It is conceivable that they are entirely intra-ovarian; it is equally possible that they are represented by extra-ovarian agents, such as specific hormones secreted by the pituitary gland or any more or less unspecific change in the constitution of the body-fluids. Similarly, it is advisable to exercise caution in the interpretation of the correlation between the progress of differentiation of the genital tract and the increase in reactivity. Reactivity, as measured by the increase in weight of the genital tract after administration of hormone might be conditioned not by differentiation itself, but by extra-uterine and extra-vaginal factors which increase in effectiveness at about the same rate at which differentiation occurs. The same applies, of course, to reactivity as expressed by the occurrence of mucification, cornification, or uterine secretion.

However, for the purpose of the present discussion, this possibility is not of fundamental importance. It is sufficient to recognize that the current conceptions of hormonic control of genital development are not in accordance with the findings described above. The hormonic theory of genital development postulates that female differentiation represents an effect of female hormones; it is found instead, that the typical effects of thelykinin—cornification and uterine activation—do not occur until differentiation has already taken place; nor can the rate of initial differentiation be manifestly influenced even by large doses of hormone. The reactivity to female hormone does not seem to be a condition of female differentiation; it is more the inverse relation which seems to prevail and the completion, or advancement, of female differentiation (as represented by the development of a differentiated uterus and a vagina), seems to determine the reaction to female hormone.

The significance of the findings described above remains but incompletely understood until certain general principles of endocrinology are brought to bear upon the experimental results. It is generally assumed than an organ possesses endocrine function if its removal produces certain deficiencies which can be repaired either by grafts or by the administration of extracts. In addition, it is generally observed that an increase in the quantity of secretion produces effects opposed to the deficiency phenomena caused by ablation of the gland. Thus, the removal of the thyroid gland produces a fall in the metabolic rate which can be neutralized by administration of thyroid extracts; excessive doses of the latter raise metabolic activity above its normal level.

Similarly, oöphorectomy results in the disappearance of the changes of the oestrous cycle (absence of cornification); injection of ovarian extracts reproduces the normal phenomena; administration of excessive doses results in "excess-phenomena" such as the persistence of cornification, which normally is periodical.[43, 33]

The experimental facts established for the newborn rat show clearly that none of the criteria of endocrine functions are obtained for the ovary of the very young rat. Oöphorectomy does not cause deficiencies for the first period of life; administration of the most important ovarian hormone fails to produce any excess phenomena such as acceleration of differentiation or pronounced growth. There is, therefore, no reason to assume that the ovary controls the first period of post-natal life with its rapid genital development.

VI. Effects of Sex Hormones in the Heteronomous Sex.

In previous chapters the effects of sex hormones upon the differentiation of the genital system of the homonomous sex have been discussed; now the related problem concerned with the effect of these substances upon the genital anlagen of the heteronomous sex remains to be dealt with. Experiments on the effects of male hormone upon the female and of thelykinin on the male seemed desirable for many reasons; since the newborn rat is used in place of the embryo, it is worth while to reproduce (in a sense) the conditions which prevail in parabiotic cattle-twins, and which have yielded so much important information on the mechanism of sexual differentiation. Parabiosis is not a method practicable in the newborn rat; the writer, at any rate, was never success-

ful in his attempts at rearing parabiotized newborn rats. Nor is transplantation of the heteronomous gonad a satisfactory method; it is difficult to rely on, or to estimate, the functional activity of the graft quite apart from the period of latency elapsing between the establishment of the graft and the time when its secretion takes effect[20]; this period may be longer than the very short span of time necessary for the advancement of differentiation. But it is possible to use extracts even though the preparations of androkinin which were available in these experiments proved to be lethal to newborn females and were only borne by animals older than three days.

(*To be continued*).

Breech : A Method of dealing with the Aftercoming Head

BY

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FEW types of labour can present more difficulties or cause more anxiety to the obstetrician than the delivery of the breech.

For a great many years breech labour has been attended by a high infantile mortality. Watts Eden[1] suggests that of the total stillbirth-rate, as disclosed in hospital reports, antenatal deaths account for at least 50 per cent, deaths in serious obstetric complications for 30 per cent, and the remaining 20 per cent occur in the absence of birth-complications, either maternal or foetal. Gibberd[2] estimated that the combined intranatal and neonatal mortality was 39 per cent in all breech cases. In view of this heavy toll of infant life it is clear, to quote Watts Eden, that "the art of managing this particular type of difficult labour has not reached a point at which we can afford to rest content."

That new principles of treatment have not been expressed and that each writer has simply perpetuated the teachings of his predecessor are clearly evident from a perusal of the textbooks published during the past 20 or 30 years. On no important point does the treatment ever appear to be questioned, and the paucity of new ideas is everywhere remarkable. While the dangers associated with too rapid delivery of the head have been duly stressed by most teachers, it cannot be denied that the necessity for a certain amount of haste, however relative this may be, is still engendered in the minds of students and practitioners because of the fear of asphyxia. To effect delivery various two-handed grips have been devised; grips which, in my opinion, induce the operator to use more force than is necessary. Unfortunately, these two factors, haste and force, are the Scylla and Charybdis between which the accoucheur is wrecked and the passenger lost.

It is intended both in this and the following contribution on the delivery of the breech with extended legs, to focus attention

on various points in relation to breech presentation and delivery, which have, in the past, been insufficiently considered. A clearer conception of the mechanism of the birth of the after-coming head will here be offered, while an account will be given of its practical application and results in a series of breech deliveries in primiparae.*

The adoption of these new ideas in actual practice has proved eminently successful in reducing the infantile mortality in the series of cases which later will come under discussion.

Diagnosis.

This is not always so easy as the textbooks would lead one to believe. When the patient is seen for the first time at about the thirty-fourth or thirty-fifth week and a moderate amount of liquor amnii is present the diagnosis is comparatively simple. Difficulty is sometimes experienced, however, when the patient is seen at about the thirty-seventh week and the legs are extended. Errors have been seen to occur so frequently in this type of case that it is interesting to consider how they arise. At this period the buttocks tend to sink deeply into the pelvic brim and Leopold's fourth manoeuvre may give the impression that it is the head that is deeply engaged in the pelvis. Whenever this grip fails to identify with certainty at least one prominence of the foetal head, the fundus should be re-examined, and if the slightest doubt still remains a vaginal examination should be made.

Antenatal period. At a time when the propriety of performing external cephalic version in every breech case passes almost unquestioned, we would emphasize that the diagnostic significance of this type of presentation should not be overlooked. Before undertaking external version every aetiological factor should be considered. If this is done the obstetrician will from time to time be rewarded by the antenatal discovery not only of a contracted pelvis but also of the presence of such serious complications as placenta praevia and hydrocephalus.

Mechanism. It is not sufficiently stressed in the textbooks that the aftercoming head should be born by a process of flexion; that is, rotation of the head about the point of contact between the sub-occipital area of the infant's skull and the descending rami of the pubes. Flexion can take place or can be produced

* Marshall, C. M. "A Technique for the delivery of the Breech with extended legs in primiparae." (See p. 930, *post*.)

within the pelvis; but if the head is simply drawn out, as is so often done, the occipito-frontal diameter distends the perineum. The increased resistance caused by this larger diameter will lead the operator to use more force than is required: the head undergoes unnecessary stress, and injury may be done to it or the child's neck. Whatever method of delivery is adopted it is important that this rotation should be carefully imitated. Smellie undoubtedly understood the importance of reproducing this flexion when, after describing the position of the hands, he added: "then stand up, and in pulling raise the body so as to bring out the head in a half-turn as above directed."

The Treatment of the Normal Breech.

First stage. In comparison with vertex presentations the period of dilatation often appears unduly tedious and prolonged. First, the soft and irregularly shaped breech is not so efficient a dilator as the hard smooth and round head; and, secondly, it is probable that the soft and plastic presenting part does not give rise to the same powerful stimulation of the cervical ganglion, which is possibly one of the factors in arousing and maintaining a rhythmic sequence in the pains. Bromides, chloral or morphine, will be found very useful in tiding the patient over this period.

In addition to the usual treatment advised in breech labour we would emphasize that we deprecate any assistance being given to the descent of the presenting part by abdominal or fundal pressure, as we are of the opinion that such interference may encourage early separation of the placenta.

In the fully flexed breech the arms and shoulders soon follow the birth of the umbilicus, and it is at this stage that the head is entering the pelvis. The child's body is allowed to hang from the vulva. This brings about flexion of the head, and brings the nape of the neck well into the sub-pubic angle. The mechanism by which this is brought about is as follows. The mother's perineum and soft tissues act as the fulcrum. The sub-occipital area of the child's skull is in contact with either (*a*) the back of the symphysis pubis or (*b*) the ischio-pubic rami. The child's body-weight, acting through the neck and across the fulcrum, forces the head to rotate on its horizontal axis. This method of producing flexion acts whether the head is just above the brim, or whether it has already entered the pelvic cavity.

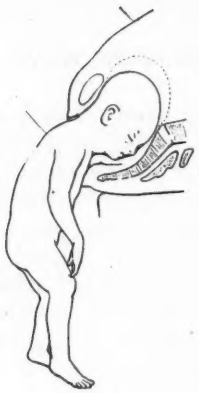

FIG. 1.
The effect of the body-weight in bringing the head through the brim

FIG. 2.
The position of the infant at the moment the grip is first applied and traction is exerted.

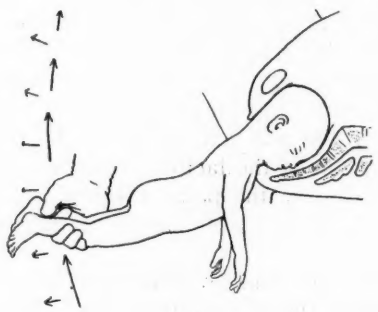

FIG. 3.
Illustrating the direction of the forces necessary for delivering the head by flexion.

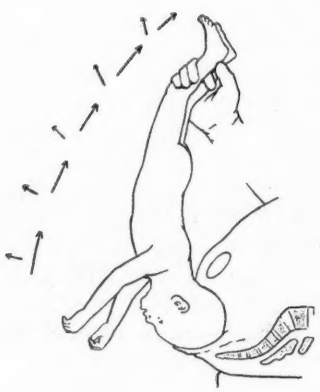

FIG. 4.
Completion of delivery

FIG. 5.
Showing the effect of elevation without sufficient traction and the danger of injury to the cervical spine.

The Authors would like to express their thanks to the Artist, Mr. Thornton Shiells, for so carefully illustrating their ideas.

The advantages of this method of treatment are:

1. Head at the brim.
   (*a*) No traction is required on the part of the operator.
   (*b*) The shortest diameters of the head are rolled through the brim, i.e. the sub-occipito frontal and the sub-occipito bregmatic diameters.
   (*c*) The minimum of force is used to produce flexion of the head, viz. the weight of the child's body.
   (*d*) Undue haste in delivery is avoided.
2. Head in the pelvic cavity.

When the head is already in the pelvic cavity flexion is still necessary in order that the shortest diameters of the head will stretch the perineum and distend the vulva. In this way lacerations may be avoided, and the head does not suffer undue stress.

The delivery of the head. It is essential that the following details should be observed:

1. The operator should stand sideways to the buttocks of the patient and use that hand which is farther away from the mother.
2. Only one hand should be used in lifting the child up over the mother's abdomen.
3. The ankles must be seized when in their most dependent position, and tension at once applied through traction applied to the legs.

This tension must be sufficient to keep the neck taut, and should be maintained throughout the lifting. If these steps are carried out the foetal head is forced to rotate about the point of contact between the sub-occipital area and the ischio-pubic rami. The perineum and vulva are distended in turn by the sub-occipito mental, the sub-occipito frontal diameters, and finally the sub-occipito bregmatic circumferences.

When standing sideways to the patient and using only one arm the operator is employing his power of abduction, which is really a very limited force. This force is further reduced by the weight of the child which has to be raised through 180 degrees. In addition, the operator's own body-weight is less likely to be called into play than if he stands facing the vulva. If tension is not maintained throughout the lifting, the head simply rotates within the pelvis, the occiput recedes and the perineum is not distended. The cervical column may become so extended as to

cause grave damage to the spine, the spinal cord or other structures of the neck.

The treatment which has just been described for the second stage of labour will be found all that is necessary in the majority of cases. There remain, however, a small number in which, owing to some slight degree of disproportion, further help will be required before the head can be brought through the brim. If the weight of the child's body is not sufficient to bring the head into the pelvis, suprapubic pressure can be applied. This must be performed by the operator himself, and not delegated to an assistant. The infant's feet are seized and tension applied by the right hand, while, with the left hand placed directly above the pubes, pressure is applied in the axis of the brim so as to force the head through the inlet and to pass the hollow of the sacrum. This combined method of applying tension to its legs and suprapubic pressure to the head will successfully deliver the infant in almost all cases.

It is not generally appreciated that eight minutes can elapse from the time the umbilicus is born until the head is delivered[3] or that five minutes may pass between the birth of the shoulders and the head. It should be realized that a great deal can be done in these periods, provided the efforts are well directed and the manipulations performed calmly and expeditiously. The fear of asphyxiation leads to increased haste in delivery, and this, together with too much force (supplied by the two-hand grips), are the main causes of the majority of the stillbirths. The head is too often pulled out instead of being rolled out in the way just described.

Third stage. In cases of breech delivery separation of the placenta is not wholly a third-stage phenomenon as it is in cases in which the head is delivered first. At the time when the head is entering, or has entered, the pelvic cavity, so much contraction and retraction of the empty upper segments are possible that the placenta, if not actually separated from the uterine wall and only retained by the membranes, has at least ceased to function physiologically.

This rapid separation which follows emptying of the uterus can frequently be appreciated when performing Caesarean section on the organ which is not even in labour. For this reason any manipulations to place the cord in such a position as to avoid its compression by the aftercoming head are entirely misdirected and irrational.

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A Technique for the Delivery of the Breech with Extended Legs in Primiparae

BY

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THERE is still a great diversity of opinion as to the best method of treatment of breech presentation with extended legs. No generally accepted teaching or well-established practice can yet be said to exist. This lack of agreement on certain fundamentals was nowhere more in evidence than in the reported proceedings of the Gynaecological and Obstetrical Section of the British Medical Association at Eastbourne in 1931.[1] Concerning the management of this type of case exactly opposite lines of treatment were advocated by two such authorities as Bourne and Holland.[2] While the former strongly recommended that the legs should be brought down, the latter just as strenuously insisted that they should be left alone. As neither produced the results of a series of cases in which one or the other method had been tried almost exclusively, the thoughtful reader was still left without any real enlightenment.

N. B. Hall and Hilda Page[3] have, during a period of ten years in Queen Charlotte's Hospital, investigated the details of 100 breech cases in which the legs were extended. Only six of these cases were delivered spontaneously with the legs extended, while in the remaining 94 cases the legs were brought down before delivery. This was tantamount, then, to a prolonged experiment in treating this type of presentation in one way—by bringing down the extended legs. It is greatly to be regretted that these authors have failed to mention much that would have been of great interest. No distinction was drawn between primiparae and multiparae; and no mention was made of the intranatal or neo-natal death-rates. In the absence of positive statements to the contrary, can it be assumed that no immediate accidents or complications accompany this method of treatment?

The present experiment proceeded along definite lines and was founded on certain conclusions and assumptions drawn from experience and observation during a resident obstetric period of nearly two years.

These conclusions were:

1. *Without assistance of some kind the primiparous woman will only rarely accomplish the delivery in time to ensure the safety of a full-time child.*
2. *The undisturbed presenting part is the best dilator of the cervico-vaginal canal and effectively prepares the passage for the aftercoming head.*

The trunk of the mature foetus with the legs extended alongside it performs this function almost perfectly. Any one who has frequently passed the hand up to recover extended arms in this type of case, must have observed how completely effaced the cervix has become. One has just as often been impressed with how rarely this complete dilatation is attained, especially in multiparae, when the presentation is a complete breech, knee or footling. This same failure of complete dilatation occurs in many premature deliveries, and may give rise to difficulty in delivering the aftercoming head. The thin, rather emaciated breech and body readily escape from the uterus, the head gives rise to unexpected delay at the time of delivery, and a hand passed into the vagina discovers the sub-occipito frontal diameter tightly encircled by the cervix.

It is not at first quite clear why the breech with extended legs should bring about such good dilatation of the cervix, for in the later part of the first stage, the presenting buttocks partially, or even completely, escape into the vagina before full dilatation has occurred. The trunk, however, with the legs extended alongside it forms an approximately cylindrical body, cross-sections of which do not vary greatly in their circumferences at different levels. The tension on the cervix is constantly and evenly maintained throughout the descent of the whole child, and there is not any period during which this tension is relaxed as must be the case after the passage of the buttocks and flexed legs in the complete breech. Whatever may be the reason and however contrary this may be to the statements of others, observations compel the conclusion that by the time the extended breech of the full-time infant is born, the cervix is either completely dilated or, at least, so little of it remains that it cannot possibly be a hindrance to the passage of the aftercoming head. During a recent delivery circumferential measurements were made as the various levels of the trunk and limbs were issuing from the vulva. These were:

(*a*) Around the presenting pole at the level of the great trochanters, 13½ inches.
(*b*) Around the trunk and lower parts of the thighs at the level of the umbilicus, 14 inches.
(*c*) Around the chest and legs below the inferior angles of the scapula, 13½ inches.

The infant weighed 7 pounds 4 ounces and was 20 inches in length. The sub-occipito bregmatic circumference was 14½ inches.

3. *An episiotomy greatly simplifies the birth of the frank breech and the aftercoming head, and renders more easy any manipulations made to assist these.*

Insufficient attention has been paid to the opinion expressed by Holland[1] that the death of the foetus occurs at the vaginal outlet. No doubt this is mainly due to the delay resulting from resistant soft parts: but the powerfully deforming force that the intact perineum is capable of offering to the rapid egress of the head is apparently another factor. If the perineum has not given, the moment the anterior end of the sub-occipito-frontal diameter distends it, the head is literally sprung out. The delivery of the head, often by force, over the intact or unprepared perineum in the primipara, must sometimes be accomplished at the expense of an acute, but transient, alteration in the cephalic diameters.

4. *The ideal technique should interfere as little as possible with the natural powers and wholehearted co-operation of the mother.*
5. *Finally, the assumption was made that the classical methods of managing the aftercoming head were not necessarily the best, and that the method advocated by Dr. Burns was more rational in that* (a) *it aims at limiting the amount of force used, and* (b) *too early and unnecessary interference with the head is prevented and the natural mechanism is encouraged and closely simulated.*

The Technique.

A technique for delivering the breech with extended legs. (The left sacro-anterior position is considered).

The delivery is begun when the anterior buttock is visible through the vulva and the posterior buttock is impinging on the perineum. However, if progress has been slow or unduly delayed, it is begun as soon as the anterior groin can be conveniently reached with the index finger of the right hand.

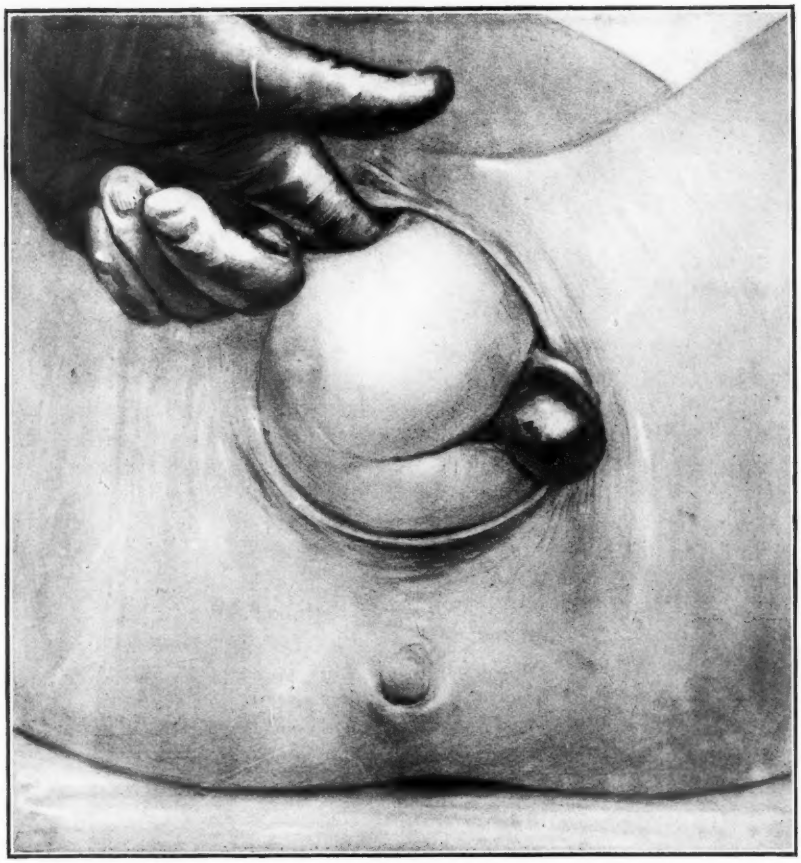

FIG. 6

Delivery of the buttocks by groin traction. It is just prior to this moment that the episiotomy is usually performed. (Drawn from a film shown before the North of England Obstetrical and Gynaecological Society.)

The buttocks of the mother are brought to the end of the table and the legs are placed in the lithotomy position. The bladder is emptied by catheter.

With the finest hypodermic needle the region of the posterior edge of vulva is infiltrated intradermically and subcutaneously with a few cubic centimetres of a solution of half per cent novocaine. A three-inch needle is inserted through this area and a fan-like superficial and deep infiltration of the whole perineum and lower part of the posterior vaginal wall is carried out. When injecting the paravaginal tissues the point and direction of the needle can be controlled by two fingers in the vagina. Fifty or more cubic centimetres are used. Especial care should be taken to ensure that the skin in the area of the proposed episiotomy is rendered completely anaesthetic. Gentle ironing of the pelvic floor is proceeded with. This can be done absolutely painlessly.

The index finger of the right hand is now passed up behind the symphysis into the anterior groin. Steady groin-traction is then made throughout the whole duration of the succeeding pains. As a rule between five and 10 pains, reinforced by the groin-traction, are required to bring the anterior buttock completely beneath the pubes and the posterior one firmly against the bulging perineum.

At this moment a medio-lateral episiotomy is made on the same side as that on which the sacrum is descending. The traction is continued and usually with the next pain the buttocks are born. (Table I). Chloroform is immediately administered on an open mask. With continued traction, or the momentum gathered with the last pain, birth as far as the umbilicus or the popliteal spaces now readily takes place. Pressure in the popliteal spaces, directed away from the mid-line, flexes the legs on the thighs and detaches the feet from the vulva. A loop of cord is drawn down, but no further attention is paid to it.

TABLE I.

In the 30 cases in which the legs were extended the buttocks were delivered:

	Cases
By the natural forces	2
By bringing down the legs	2 (or 6.6 per cent)
By groin-traction and natural forces ...	26
	30

In the six cases in which the complete breech presented extraction was practised as soon as the feet and the buttocks were at the vulva.

The buttocks are grasped with the thumbs over the sacrum and gentle tension maintained. More of the trunk continues to be born. No set rule is followed with regard to the moment when the arms should be brought down. If the scapulae, or axillae, readily appear at the vulva, the arms are probably flexed and thus delivery is accomplished with ease. Much more often in this series of cases the arms were extended. The posterior arm is sought as soon as a definite resistance to further traction is experienced. The ankles are grasped with the left hand, the trunk raised so that the infant's abdomen approaches the mother's right groin, while the right hand is passed up over the right shoulder and the bend of the elbow reached with the tips of the fingers. The arm is flexed and brought down over the chest and through the vulva. A little further traction, at the same time depressing the body, will frequently bring the anterior scapula into view, and the bend of the arm can usually be reached with two fingers. The elbow is flexed and the arm swept out. It will be noted that the posterior arm is delivered earlier than is generally recommended.

As soon as the arms are delivered the body is gently released and allowed to hang from the vulva. In slightly less than half the cases the amount of visible neck will lengthen, and in a few cases the trunk may be seen to undergo a short sharp drop, the head having entered the pelvic cavity. The ankles are once again grasped in a towel and the delivery of the head effected by adopting the stance and the leg-traction method described by Dr. Burns.

TABLE II.

Delivery of the head through the brim—36 *cases*:

	Cases
By body-weight alone	16
By body-weight and suprapubic pressure	19
By Mauriceau's method and suprapubic pressure	1
	36

Delivery of the head through the pelvis—36 *cases*:

	Cases	
By leg-traction and tension	12	
By suprapubic pressure and leg-traction	16	
By Mauriceau's method and suprapubic pressure	2	(1 stillbirth)
By the forceps	6	
	36	

There are really three phases in the delivery of the head; its passage through the brim, its descent through the pelvis, and its rotation round the symphysis through the outlet. The episiotomy usually abolishes any real difficulty at the outlet. Delay, or difficulty, in entering the brim demands further assistance, which aids but does not supplant the leg-traction. Pressure with the free hand applied to the vertex just above the pubes will aid its entry through the brim, while by deep invagination of the abdominal wall with the closed fist the head may be slowly forced through the pelvis. (Table II).

Some Observations of this Type of Labour.

This series comprises 36 consecutive breech deliveries in primiparae. In 30 of them the legs were extended and the weights of these children are as follows: Over 8 pounds, 2 cases; over 7 pounds, 16 cases; over 6 pounds, 10 cases; over 5 pounds, 2 cases. The average weight was 7 pounds. Almost every case was frequently seen throughout labour, and the dilatation of the os and the descent of the buttocks carefully followed by rectal and vaginal examinations.

Engagement. At the onset of labour the rather conical breech is almost invariably fixed in the brim; it is often much more deeply engaged. This occurs even in the presence of slight pelvic contraction. Such deep engagement is the exception rather than the rule in complete breech presentations. The buttocks with the feet alongside them are usually found to be sitting lightly in the brim. Prolapse of the cord in this group is not very uncommon. I have never seen it occur in association with the breech with extended legs, and a careful search of the records of the Liverpool Maternity Hospital for the last seven years has failed to discover such a case.

Premature rupture of the membranes. The membranes ruptured before or shortly after the onset of labour in almost a third of the cases in which the legs were extended. No ill effects were evident. On the contrary, the average duration of labour in these cases was considerably shorter. The many virtues attributed to intact membranes are not always apparent, provided, of course, that the presenting part is engaged and well applied to the cervix.

Nevertheless, in the complete breech presentation every endeavour should be made to preserve them intact as long as possible.

Dilatation and descent. If the buttocks are deeply engaged at the onset of pains, very little descent takes place until almost full dilatation is reached. However, when the breech is only fixed in the brim considerable descent occurs *pari passu* with the opening of the cervix. The rather conical pole of the child enters the vagina while some cervix still persists. But this is usually completely obliterated by the time the breech is on the pelvic floor and deeply in the hollow of the sacrum, or, at the latest, when the buttocks are at the vulva. This descent into the hollow of the sacrum is usually accomplished rapidly, and only rarely does it require more than 30 minutes of second-stage pains. The greater part of the second stage is devoted to forcing the buttocks round the pelvic curve, over the edge of the levator sling, and through the vulva. The technique described materially shortens this latter period just as the low forceps operation may shorten the second stage when the vertex is presenting.

Undue delay in the arrival of the breech in the hollow of the sacrum should arouse suspicion, and the size of the foetus and the pelvis must once again be considered, for occasionally this delay is due to disproportion. Too frequently, perhaps, this type of case is treated by bringing down the legs with immediate or delayed extraction.

Faced with such delay during the late part of the first stage and early part of the second stage, the possibility of Caesarean section should be seriously considered. It is here that one of the strongest arguments arises against the routine of bringing down the legs at, or before, full dilatation. The great diagnostic value of this period of the descent—from full dilatation to hollow of sacrum—is partly lost. The argument made is this: once the breech with extended legs has reached, within a reasonable period of time, the region of the hollow of the sacrum, the trial of labour is over, and delivery by the method just described will nearly always be possible.

It is not denied that indications may arise which necessitate bringing down the legs. It is the time and place which are in question. Common arguments adduced in favour of early interference are (1) that the procedure is then much easier, and (2) that future difficulties, if they arise, are more readily dealt with. This intelligent anticipation of difficulties would have much to commend it if these commonly arose. We have all met the case which has been grossly neglected, the breech is deeply impacted in the pelvis. the liquor has long since drained away and

permanent retraction of the uterus has occurred. But in hospital practice a case which has been carefully followed should never reach such a state. It requires only ordinary powers of perception and an elementary sense of touch to determine when, despite the presence of uterine contractions the buttocks have ceased to descend. This is then, apart from urgent maternal or foetal necessity, the only indication for decomposing the breech and extracting; and then it should be done only if the inaccessibility of the groin renders the above method impracticable. (It is interesting to note that in none of these 30 cases did a condition arise which could be included under either of the headings "Maternal distress' or "Foetal distress".) Owing to the rapid descent of the buttocks, it becomes easily evident, after one and a half hours in the second stage, whether the operation is called for or not; and at this moment it can still be performed with ease if attention is paid to certain details.

The procedure should not be attempted until the patient has been deeply anaesthetized. Ether is perfectly satisfactory and safe. A catheter is passed. A gauntlet glove should be worn and this should be well lubricated as far as the elbow. The vulva and lower part of the vagina are thoroughly stretched and ironed out. The whole hand is inserted, and with gentleness and patience the buttocks can be carried up on the palm to the more roomy region of the brim. This is the essential step of the operation. The succeeding manipulations are carried out according to the ordinary classical descriptions.

In only two cases was this necessary. Both were emergency admissions. In one the cervix had been fully dilated for five hours, and attempts had been made under general anaesthesia to bring down the legs. The breech was firmly impacted. Under deep anaesthesia with ether it was readily pushed up, the legs brought down and the child extracted. The infant weighed 7 pounds 8 ounces. The mother was 38 years of age, and the diagonal conjugate diameter was $4\frac{1}{2}$ inches. The other patient had a slightly flat pelvis, the diagonal conjugate being $4\frac{1}{2}$ inches. The anterior buttock was visible on separating the labia. Episiotomy and groin-traction failed. This infant weighed 6 pounds and 8 ounces. Both children were born alive.

Perineal anaesthesia. With the increased relaxation of the pelvic floor and the abolition of perineal pain, the patient will often use her pains to much greater advantage. A resort need not be made to general anaesthesia until after the episiotomy and the birth of the buttocks.

Birth of the buttocks and episiotomy. Whether it be the girth of the body with the limbs extended alongside it, or solely the splinting action of the legs, there is no doubt that the breech finds great difficulty in traversing the lower curved part of the pelvic canal. The chief site of frequent delay is actually on the perineum. Here the buttocks have been watched, appearing and receding, for periods varying from 30 minutes to one hour. The episiotomy once performed, the perineum falls back before the advancing part and the buttocks are rapidly born, rather towards the operator than towards the ceiling. The increased rigidity of the trunk is compensated for by this alteration in the direction of the pelvic canal. If the episiotomy is omitted unnecessary delay occurs and the perineum is often torn by the issuing breech; or, if it escapes at this moment, by the manipulations necessary to recover the extended arms. At no time is it permitted to assist the descent or birth of the buttocks by abdominal or fundal pressure.

Extended arms. Within my own knowledge no single factor has been such a fruitful cause of stillbirth in breech-delivery as delay or difficulty in delivering extended arms. It can certainly be one of the most difficult manoeuvres in obstetric surgery, and the one which all beginners find most troublesome to master. Occasionally the anterior arm may be converted into a posterior one by rotation of the child and delivered as such. Extended arms should be brought down early before they become impacted with the head in the upper part of the pelvis. The treatment of a nuchal displacement depends, for its success, on its rapid recognition. This complication arose three times in the series of cases dealt with. (Table III.)

TABLE III.

Position of the arms.

In	23	cases	both arms were extended.
In	5	cases	only one arm was extended.
In	8	cases	both arms were flexed.
In	3	cases	nuchal displacement of the extended arm occurred.

Delivery of the head (Table II). The method advocated for delivering the head has been almost the only one used for nearly a year, both in primiparae and in the difficult delivery of many large babies after podalic version in multiparae. Suprapubic pressure is the method now used in the majority of cases in which

the weight of the child's body and the method of leg-traction do not suffice. The forceps was resorted to in a few of the early cases, but it is nearly a year since the necessity for its use has arisen.

In a small number of cases the employment of the forceps is highly desirable, if not indispensable. In the hands of one who is accustomed to applying it with gentleness and expedition, very good results are obtained. If the axis of traction during every phase of the delivery is maintained in the ideal direction, the normal flexion is preserved and the head is finally rolled, and not dragged, through the outlet; the forceps, thus, promotes the mechanism we have been advocating. Further, there is a possibility that the instrument possesses a splinting action which prevents acute alterations in the cephalic diameters.

In conclusion, the writer's attitude towards the delivery of the head may be briefly stated. In almost half the cases the weight of the body will bring the head completely into the pelvis; leg-traction and tension, with occasionally a little pressure from above, will complete the delivery. When the head fails to enter the pelvis moderate suprapubic pressure is applied. If the head descends in response to this, the delivery is continued as above. A combination of the above manipulations will easily deliver the head in nearly all multiparae, and in about 80 per cent of primiparae. Very rarely (one case of partial extension occurred in this series) either due to mismanagement or to disproportion, the head becomes extended above the brim. Suprapubic pressure will fail. The mouth of the child is sought with the fingers, its head is flexed, and with two fingers of the other hand over its shoulders the head is guided through the brim. Mauriceau's manoeuvre is the only way of dealing with such a complication. In a very few cases in which, from the difficulty in delivering the buttocks and extended arms, or from the size of the trunk, disproportion between the head and the pelvis can be reasonably anticipated, the forceps is at once resorted to if the usual method fails. This instrument will, indeed, give poor results if applied only after vigorous and prolonged attempts by other methods have been made.

To Dr. Burns, both in regard to this feature of the work and for his sustained interest and help, I acknowledge my indebtedness.

Maternal results. There was no maternal mortality. The puerperium was morbid in one case, or 2.7 per cent.

Foetal results. The onset of respiration. In all the 35 infants born alive the onset of respiration was immediate and spontaneous. Artificial methods of resuscitation were never required. The short chloroform anaesthesia did not cause any adverse effects.

Foetal injuries. Two infants manifested transient signs of injury to the brachial plexus. These had completely vanished within seven days. In one infant the clavicle was fractured when passing the hand between the symphysis and the shoulder to deliver the anterior extended arm. The diagonal conjugate diameter in this case was $4\frac{1}{2}$ inches, and the foetus weighed six pounds and 15 ounces. No infant during its stay in hospital presented any symptoms of intracranial injury.

Foetal mortality. One infant was stillborn, a mortality of 2.7 per cent. This was an early case delivered with difficulty through the outlet by Mauriceau's manoeuvre. The mouth had passed over the perineum and breathing had been established. The autopsy showed no evidence of macroscopic intracranial damage. This infant weighed seven pounds and 11 ounces; it was 20 inches in length.

Summary and Conclusions.

1. A method has been described for the management of the aftercoming head which (*a*) encourages the normal mechanism of flexion and rotation within the pelvis, (*b*) prevents too early and unnecessary manipulations, and (*c*) diminishes the amount of force used in effecting delivery.

2. The delivery of the breech with extended legs in primiparae has been considered. A technique is described which renders assistance to the birth of the infant, offers considerable relief from pain, yet in no way interferes with the active co-operation of the mother until the buttocks are born.

3. Decomposition and extraction of the extended breech is rarely called for. The closest parallel to this manoeuvre is the mid-forceps operation, and the indications for interference should be just as strictly observed in the former as they are in the latter procedure.

4. To the application of the above methods must be attributed in some degree the improved results obtained in the Liverpool Maternity Hospital during 1933. These are set out in the accompanying table.

	Number of cases	Foetal deaths	Foetal mortality per cent
Normal breech deliveries. (Few or no manipulations required except for the normal delivery of the head)	36 (17 twins)	1 (in a 3-para)	2.77
Difficult breech deliveries. (Further manipulations required, such as groin-traction, bringing down extended arms, bringing down legs, episiotomy, etc.)	36 (28 primiparae)	1 (primipara)	2.77
Complicated breech deliveries. (Breech by version, placenta praevia, accidental haemorrhage, etc.)	65	38	58.4

Final mortality in uncomplicated cases: Two stillbirths in 72 cases (32 primiparae), or 2.77 per cent.

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The Surgical Anatomy of the Presacral Nerve

BY

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THE presacral nerve of Latarjet, superior hypogastric plexus of Sappey, plexus hypogastricus magnus (Tiedmann), plexus divisionis aortae (Valentin), inferior aortic plexus (Beck), aortic plexus (Lee), lumbo-aortic plexus (Hirschfeld), hypogastric plexus (Dahl, Thane, Stopford), presacro-lumbar plexus (Jiano), ilio-hypogastric plexus, superior pelvic plexus—is that portion of the abdominal sympathetic system which lies anterior to the bodies of the fourth and fifth lumbar vertebrae, in the interval between the common iliac arteries. The designation "Presacral Nerve," suggested in 1913 by Latarjet and Bonnet, is both misleading and inappropriate, as the plexus is almost entirely pre-lumbar in position, and takes the form of a single nerve in a minority of cases. The adoption of this name, however, by the Lyons School of Anatomists and Surgeons, and its subsequent popularity elsewhere as a less cumbrous title than any other, has resulted in a confusion as unfortunate as it was inevitable; and until a general acceptance of the more correct denomination is achieved, it will be necessary to use the two descriptions—"superior hypogastric plexus" and "presacral nerve"—indiscriminately.

Literature. With certain exceptions the older anatomists appear generally to have omitted any very detailed investigation into the anatomy of the plexus; and their descriptions, both original and re-edited, are uncertain and of questionable accuracy—faults evident in the collateral accounts in most of the modern anatomical textbooks. Its existence was first noted by Haller,[1] who described it as the continuation downwards on the last lumbar vertebrae of a pre-aortic plexus. Sappey[2] repeated and illustrated this description, and gave the plexus its more rational name. Tiedmann,[3] recognizing the considerable part played by the plexus in the innervation of the uterus, suggested the name "plexus uterinus communis" as an adequate functional and anatomical description, and again depicted it as a complex

plexus, the lowest part of an "aortico-abdominal" plexus. Swan[4] shows it as an extremely wide mass of fine, parallel, intercommunicating nerves. Lee,[5] on the other hand, depicts it as a single narrow nerve (consisting, however, of several macroscopically apparent fibres), and in another place[6] as two parallel nerves of considerable size, similarly composite in structure. Valentin[7] describes it as a wide complicated plexus—the "plexus divisionis aortae abdominalis inferioris," and Beck[8] gives a similar account to that of Swan, describing a wide plexus of fine parallel nerves, the "inferior aortic plexus." Hirschfeld[9] illustrates a dissection of Ludovic's, in which the plexus appears as a wide plexiform nerve. Frankenhauser[10] depicts his "plexus uterinus magnus" as a single narrow flat cord, while Henle[11] shows it as consisting essentially of two widely-separated parallel nerves with many intercommunications. Schwalbe[12] depicts it in an adult dissection as a widely-meshed plexus, but in that of a child as a single narrow nerve. Thane[13] calls it the "hypogastric plexus," and describes it as "an assemblage of nerves." Stopford[14] and Dahl[15] both illustrate the arrangement of fine parallel nerves originally described by Swan and Beck, while Deaver[16] and Ranson[17] similarly repeat Sappey's initial "spider's-web" description.

It is, however, only in recent years that any very definite attempt at careful investigation into the anatomy of the presacral nerve has been undertaken, most notable among these researches being those of Hovelacque, Latarjet, Segond, Roussel, Ferey, and Kalberg. Painstaking and exhaustive though this work has been—and possibly because of these factors—the variations in the findings of different writers on the morphology of the plexus are even wider than those exhibited by the older authors. According to the former, the plexus may present itself as a single median nerve or as a widely-meshed plexus occupying all the space between the common iliac arteries, with all variations between the two extremes. Some idea of the extent of this variation may be obtained from the following analysis of the findings of different workers:

Hovelacque,[18] from his investigations in 100 dissections, concludes that though it may be single, double, or a plexus, it is "usually a widely fenestrated plexus of several main trunks." Kalberg[19] investigated the anatomy of the plexus in 38 dissecting-room cadavers of all ages, varying from one month to 78 years. In 23 cases a plexus of three or four parallel intercommunicating nerves was present; in seven, two single larger nerves ran nearly

parallel, meeting for a very short interval in the middle of their course; in only eight was the plexus represented by a single nerve, and of these four were females. Chianallo,[20] in 32 cadavers, found a plexus in 53 per cent, a single cord in 22 per cent, two groups of nerves in 15 per cent, and two single nerves in 10 per cent. Delmas and Laux[21] found a true plexus formation in 80 per cent of 20 dissections, with a single nerve in the remainder. Cordier,[22] dissecting eight bodies, encountered the plexus in all cases as "a flat irregular band, made up of dense fibres united to each other by short anastomoses and fibrous tissue." Latarjet[23] has repeatedly asserted his belief that it usually manifests itself in the form of his single "presacral nerve," an opinion which, though formerly adopted by his surgical colleague Cotte,[24] has latterly[25] been discarded by that authority in his modified operation for resection of the presacral nerve, the technique of which is based on the occurrence of more than one nerve in the plexus. Bergier[26] and Morrison-Lacomb[27] both agree with Latarjet's conception of the single nerve. Roussel[28] found a single cord in 75 per cent of his dissections, a wide plexiform cord in 25 per cent, and a widely-meshed plexus in 5 per cent. The same author quotes Le Grand[29] to the effect that in four patients upon whom that surgeon performed presacral sympathectomy, the nerve presented itself as a clearly-cut cord in three, while in the fourth there was a wide plexiform arrangement. Ferey,[30] from the results of his dissections in 15 cadavers, would entirely reverse Roussel's figures. He found a plexus present in 13 cases (85 per cent), two cords in one case, and a single nerve in the last. He considers that in the majority of cases the plexus exhibits itself either as a flat plexus (33 per cent), or as several fine parallel nerves (55 per cent). Jianu, Tzovaru, and Bratiano[31] examined nine presacral nerves removed by them at operation. In all cases there were "several fairly big nerve-bundles of 3 to 5 mm. in width, with fine transverse anastomoses, the whole forming a wide sheet." Bernard and Theodoresco,[32] in their operative series, found seven or eight fine filaments in four cases, two fairly big nerves in three, and three fine parallel nerves in an eighth. Laux[33] states that a plexus is present in 80 per cent of cases, and a single nerve in the remaining 20 per cent. Learmonth,[34] quoting a similar percentage, suggests that the usual arrangement found at operation is one of two parallel nerves with many communications. Delmas and de Rouville,[35] stressing its variability, state that the plexus usually takes the form of "a plexus of anastomosing nerves in a fine connective-

tissue sheet triangular in shape, the fibres being condensed at the borders of the triangle. . . . A single nerve is unusual." Segond[36] found in his dissections that the plexus presented itself much more often as several multiple nerves than condensed into a single nerve. Mornard[37] did not find a single nerve in any of his three operative cases, and considers it the exception to find one. Binet and Beau[38] express a similar opinion. Hartmann-Weinberg,[39] investigating the anatomy of the plexus in man and the anthropoids, found it to consist in all cases of a series of from three to five fine parallel nerves. Fontaine and Hermann[40] state that "it has been our experience that the nerves are usually in plexus formation, and rarely combined into a single trunk." Lawen[41] reproduces a diagram of Corning's showing a "spider's-web" plexus; Renner[42] depicts a wide plexus formed from three communicating nerves; Adamson and Aird[43] a narrow bundle of fine parallel fibres; while Foulds[44] and Bartrina[45] found a single true presacral nerve present in their cases. Lastly, Elant,[46] in a very recent publication, states that in 50 dissections he encountered 12 cases with distinct nerves, eight cases with parallel fibres, 29 cases with typical plexûs, and one case with an arch-shaped plexus.

The foregoing *résumé* reveals a variety of opinions on the anatomy of the superior hypogastric plexus almost bewildering in their apparently fundamental differences. A considerable number of competent authorities are shown to have investigated the question in both its anatomical and surgical aspects, yet though collateral work exhibits fairly general agreement concerning the origins and connexions of the plexus, the actual form it adopts, both in the cadaver and at operation, remains the subject of the liveliest disagreement. Every type of nerve arrangement has been found by different observers, each of whom suggests that the conformation described by him is typical of the majority of cases. There would not appear to be any possibility of correlating these separate opinions, but it will be noticed that most of the later work, emanating as it does from the two great French schools of neurological anatomy at Paris and Lyons, has tended to drift into a series of verifications and contradictions of the original findings of their respective directors, who may be taken as representing the extremes of modern opinion on the subject—very adequately expressed by Latarjet's denomination of "presacral nerve" as opposed to Hovelacque's "superior hypogastric plexus."

Which, then, of these two divergent views is the correct one, and in what way has the difference arisen? It is hoped that the

following considerations will materially help to establish the former, and provide an explanation of the latter.

Personal Investigations.

The plexus, with its branches of origin and distribution, was dissected in the following preparations: Thirty consecutive adult cadavers (25 of these were dissecting-room formalin-preserved bodies, of ages ranging from 45 to 75 years, one was Kaiserlin-prepared, and four were fresh post-mortem room bodies examined within 12 hours after death); eight full-time stillborn children (examined fresh and unpreserved on the day of delivery); 10 foetûs (human, fresh, and of varying stages of development); 20 operative specimens. (The specimens removed by Cotte's operation—"resection of the presacral nerve"—were teased out immediately after their removal from consecutive cases).

The dissections were drawn, or photographed, to illustrate the relations and connexions of the plexus, which was then resected and photographed to show its more detailed constitution. The operative specimens were carefully denuded of fat and connective-tissue, fixed in formol-saline, photographed, and, with the anatomical specimens, examined histologically.

Connexions of the Presacral Nerve.

To appreciate the causation of the apparent variations in the shape adopted by the plexus in different circumstances, it is necessary to examine the connexions which are in part responsible for them. These are shown in Fig. 1, which represents their average disposition in my cases. (It should be noted in passing that nothing is more variable than the abdominal sympathetic system, and that consequently even "averages" concerning it cannot fail occasionally to appear somewhat arbitrary). It will be seen that the plexus has connexions superiorly, inferiorly, and laterally. Above and laterally it is connected with the solar plexus and upper lumbar ganglia via the intermesenteric nerves, of which, indeed, it is the direct (fused) continuation downwards. These nerves are disposed as double or triple parallel strands of considerable size on either side of the aorta, those of the right side lying at a greater distance from the vessel than the corresponding ones on the left, the latter being closely adapted to its lateral surface. (The difference is merely a relative one due to the position of the aorta on the left of the mid-line). The nerves arise by three roots from the renal or aortico-renal ganglion, the circum-arterial renal plexus, and the transverse aortic bar, but

receives a considerable accession of fibres from the upper ganglia of the lateral sympathetic chain. Thus constituted, they pass downwards and medially to gain the anterior surface of the aorta, upon which they course to the bifurcation, at which level they join to form the superior hypogastric plexus. In their course the nerves both distribute and receive filaments from the inferior mesenteric ganglion and plexus, and before terminating receive branches from the lower lumbar ganglia.

In the middle line the plexus is connected above with the inferior mesenteric ganglion (when present), or (and) with the inferior mesenteric circum-arterial plexus. The branch or branches from these structures may join it directly at its origin, or may pass directly to the intermesenteric nerves before their fusion. Laterally the plexus receives a fine branch from the lowest lumbar ganglion of each side, this ganglion being usually situated at too low a level to allow of its median supply reaching the intermesenteric nerves in the manner adopted by those more superiorly placed. (The word "lowest" is used advisedly, on account of the extreme variation in the actual number of ganglia exhibited in this portion of the lateral sympathetic cord). Occasionally the next more proximally placed ganglia participate in this direct supply to the plexus.

The ganglionic branches under consideration emerge from the inferior extremity of the medial borders of the respective ganglia in the form of long and extremely fine filaments of tough consistence. They are usually single, and pass downwards and medially behind the corresponding common iliac artery, lying between that vessel and its companion vein. This relation to the artery is almost constant—on only two occasions have I seen the nerve pass anteriorly to it, and in both cases the parent ganglion lay at a somewhat higher level than usual. The nerves reach the plexus at varying levels, but usually join it near its proximal extremity and upon its posterior aspect. When a single "presacral nerve" is present, they fuse with its lateral borders or enter its posterior surface; in the more usual cases, in which a true plexus presents, they join the most laterally placed of the constituent nerves.

When the lowest lumbar ganglion is situated medially to the common iliac vessels, its branch to the superior hypogastric plexus is very short, and runs horizontally or even obliquely upwards from the ganglion. In those cases in which the first sacral ganglion supplies the plexus, its branch is placed similarly. (This last supply, however, is unusual, the sacral ganglia of each side communicating with each other by means of a horizontally

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Personal Investigations.

The plexus, with its branches of origin and distribution, was dissected in the following preparations: Thirty consecutive adult cadavers (25 of these were dissecting-room formalin-preserved bodies, of ages ranging from 45 to 75 years, one was Kaiserlin-prepared, and four were fresh post-mortem room bodies examined within 12 hours after death); eight full-time stillborn children (examined fresh and unpreserved on the day of delivery); 10 foetûs (human, fresh, and of varying stages of development); 20 operative specimens. (The specimens removed by Cotte's operation—"resection of the presacral nerve"—were teased out immediately after their removal from consecutive cases).

The dissections were drawn, or photographed, to illustrate the relations and connexions of the plexus, which was then resected and photographed to show its more detailed constitution. The operative specimens were carefully denuded of fat and connective-tissue, fixed in formol-saline, photographed, and, with the anatomical specimens, examined histologically.

Connexions of the Presacral Nerve.

To appreciate the causation of the apparent variations in the shape adopted by the plexus in different circumstances, it is necessary to examine the connexions which are in part responsible for them. These are shown in Fig. 1, which represents their average disposition in my cases. (It should be noted in passing that nothing is more variable than the abdominal sympathetic system, and that consequently even "averages" concerning it cannot fail occasionally to appear somewhat arbitrary). It will be seen that the plexus has connexions superiorly, inferiorly, and laterally. Above and laterally it is connected with the solar plexus and upper lumbar ganglia via the intermesenteric nerves, of which, indeed, it is the direct (fused) continuation downwards. These nerves are disposed as double or triple parallel strands of considerable size on either side of the aorta, those of the right side lying at a greater distance from the vessel than the corresponding ones on the left, the latter being closely adapted to its lateral surface. (The difference is merely a relative one due to the position of the aorta on the left of the mid-line). The nerves arise by three roots from the renal or aortico-renal ganglion, the circum-arterial renal plexus, and the transverse aortic bar, but

receives a considerable accession of fibres from the upper ganglia of the lateral sympathetic chain. Thus constituted, they pass downwards and medially to gain the anterior surface of the aorta, upon which they course to the bifurcation, at which level they join to form the superior hypogastric plexus. In their course the nerves both distribute and receive filaments from the inferior mesenteric ganglion and plexus, and before terminating receive branches from the lower lumbar ganglia.

In the middle line the plexus is connected above with the inferior mesenteric ganglion (when present), or (and) with the inferior mesenteric circum-arterial plexus. The branch or branches from these structures may join it directly at its origin, or may pass directly to the intermesenteric nerves before their fusion. Laterally the plexus receives a fine branch from the lowest lumbar ganglion of each side, this ganglion being usually situated at too low a level to allow of its median supply reaching the intermesenteric nerves in the manner adopted by those more superiorly placed. (The word "lowest" is used advisedly, on account of the extreme variation in the actual number of ganglia exhibited in this portion of the lateral sympathetic cord). Occasionally the next more proximally placed ganglia participate in this direct supply to the plexus.

The ganglionic branches under consideration emerge from the inferior extremity of the medial borders of the respective ganglia in the form of long and extremely fine filaments of tough consistence. They are usually single, and pass downwards and medially behind the corresponding common iliac artery, lying between that vessel and its companion vein. This relation to the artery is almost constant—on only two occasions have I seen the nerve pass anteriorly to it, and in both cases the parent ganglion lay at a somewhat higher level than usual. The nerves reach the plexus at varying levels, but usually join it near its proximal extremity and upon its posterior aspect. When a single "presacral nerve" is present, they fuse with its lateral borders or enter its posterior surface; in the more usual cases, in which a true plexus presents, they join the most laterally placed of the constituent nerves.

When the lowest lumbar ganglion is situated medially to the common iliac vessels, its branch to the superior hypogastric plexus is very short, and runs horizontally or even obliquely upwards from the ganglion. In those cases in which the first sacral ganglion supplies the plexus, its branch is placed similarly. (This last supply, however, is unusual, the sacral ganglia of each side communicating with each other by means of a horizontally

placed filament lying behind the plexus and its terminal branches).

Below, the plexus terminates by dividing into the paired inferior hypogastric plexûs. These usually consist of two long nerves united by many oblique anastomoses, and constitute the "hypogastric nerves" of Latarjet. Each runs downwards, outwards and forwards on the lateral wall of the pelvis to gain the utero-sacral folds, in which they course on each side of rectal ampulla, to terminate in the postero-superior angle of Frankenhauser's plexus.

In the relatively undissected state, the superior hypogastric plexus—except when it adopts the form of an extremely widespread sheet—spreads out below into a neuro-fibrous lamina of triangular shape, the plexus entering at the apex of the triangle, the inferior angles of which give origin to the inferior hypogastric plexûs. When more careful dissection is adopted, and the fibrous content of the lamina removed, it will be seen that in some cases very little nervous tissue is present, the superior hypogastric plexus passing directly into its terminal inferior hypogastric plexûs. In most cases, however, and most particularly in the presence of a true single "presacral nerve," the triangular sheet will be found to contain an abundance of nerve filaments running in all directions, forming a widely meshed plexus of considerable size. It is to this structure that I have ventured to give the name of "middle hypogastric plexus." It is a true plexus, and very occasionally contains tiny macroscopic ganglia. Histologically it is identical in structure with the superior hypogastric plexus. The plexus also gives circum-arterial twigs to the vessels in relation with it. These are:

(*a*) The superior haemorrhoidal artery. The branches to this vessel are one or two extremely fine filaments which leave the left side of the superior hypogastric plexus at its upper end to pass laterally into the pelvic meso-colon, where they join the artery. They are distributed with it to the pelvic colon, and one or two very fine branches may also be seen entering Frankenhauser's plexus independently.

(*b*) The external iliac artery. Latarjet and Bonnet[23] discuss the branches to this vessel as though they are of usual occurrence. I have, however, in spite of careful search, found them in two cases only, and in both they were unilateral and of extreme fineness. It would appear that in the majority of cases the circumarterial supply to the vessels in question is derived directly from the intermesenteric nerves.

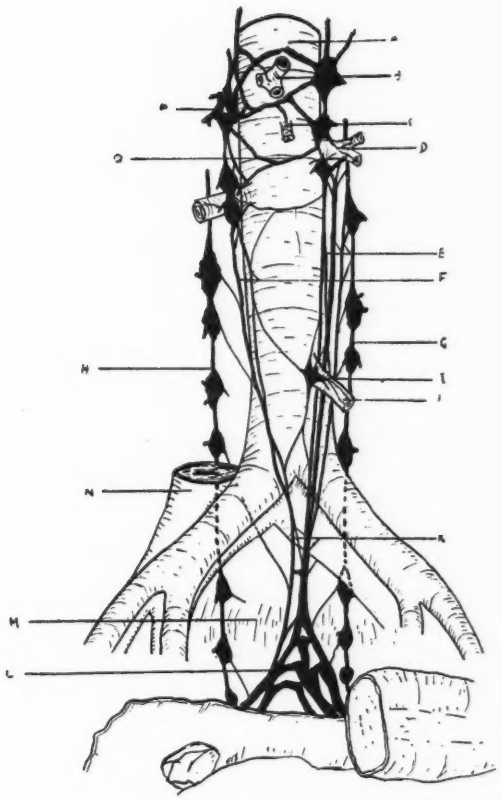
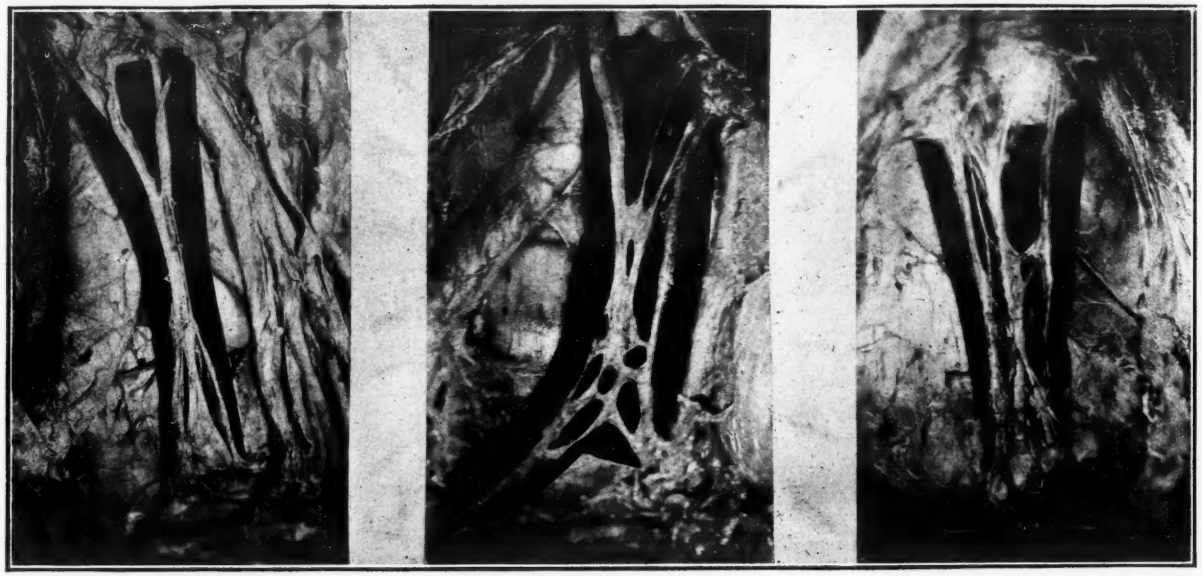


FIG. 1

The Connexions of the Presacral Nerve

(A) Aorta. (B) Coelia axis. (C) Sup. mes. art. (D) Left renal art. (E) Left intermesenteric nerves. (F) Right intermesenteric nerves. (G) Left ganglionated cord. (H) Right ganglionated cord. (I) Inferior mesenteric ganglion. (J) Inferior mesenteric art. (K) Presacral nerve. (L) Middle hypogastric plexus. (M) Promontory. (N) Inferior vena cava. (O) Transverse aortic bar. (P) Solar plexus, right portion.



A B C

FIG. 2

Three Types of Superior Hypogastric Plexus (Presacral Nerve)

(A) represents the true single "presacral nerve" of Latarjet (10 per cent of cases); in (B) a similar nerve is accompanied by a lateral finer accessory (4 per cent); while (C) is the common type of moderately wide plexus composed of two or three parallel inter-communicating nerves (70 per cent).

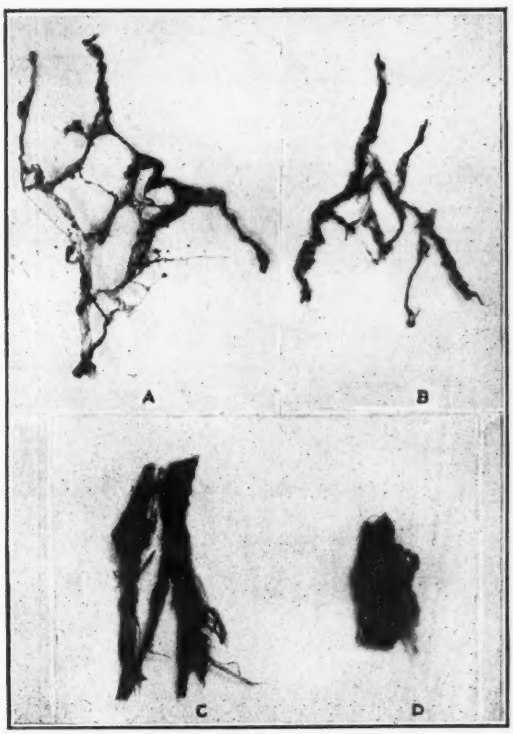
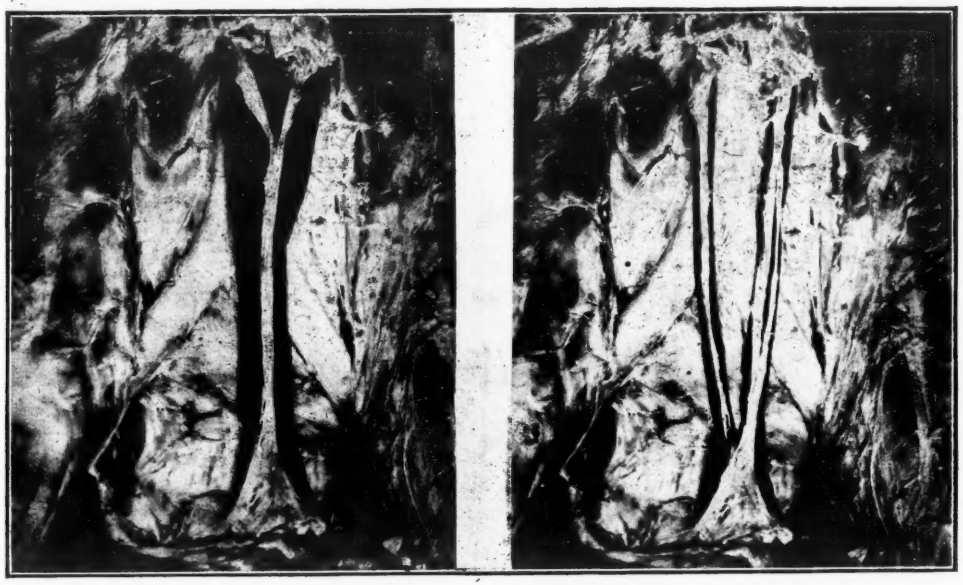


FIG. 3

To illustrate the changes in the appearance of the Presacral Nerve as the result of post-mortem preservation.

(A) (B) Specimens removed by operation. (C) (D) Specimens removed from formalin-preserved dissecting-room cadavers.



A B

FIG. 4

Illustrating the differences in appearance exhibited by the Presacral Nerve following (A) *superficial, and* (B) *detailed, dissection.*

(*c*) The middle sacral artery. The branches to this artery are similarly very uncommon. They take the form of two very fine filaments, which lie separately on either side of the vessel for a centimetre or so before fusing.

On one occasion only have I been able to demonstrate connexions of the superior hypogastric plexus with the lateral sympathetic chain itself (exclusive of the ganglia), as described by Latarjet and Bonnet. In this case two short transverse bands of fine calibre but considerable strength joined the two structures.

Form of the Plexus.

As above stated, the varying forms adopted by the plexus are the direct result of the correspondingly varying disposition of its main connexions, more particularly the intermesenteric nerves. When these latter join, an apparently single nerve results from their fusion. When they remain independent a plexus is formed, the width of which, varying between wide limits, depends upon the relative amount of separation retained by the nerves in their downward course. Indeed it may be stated that the configuration of the superior hypogastric plexus depends almost entirely upon the degree of convergence attained by the intermesenteric nerves at their termination.

This fact provides one of the explanations for the variations in shape of the plexus. It is well illustrated in Fig. 2, in which are depicted the various types of plexus classified according to shape. (The rare occurrence of a "spider's-web" plexus does not negative this hypothesis, as the nerves in question can usually be traced through the tangle). Thus in A, where the intermesenteric nerves have fused completely, a single true presacral nerve results. Where fusion is incomplete (B) this presacral nerve is accompanied by a second, and occasionally a third, parallel but finer nerve. When the nerves remain separate, a plexus of parallel intercommunicating fibres is formed, varying in width with the degree of divergence of the initial constituents (C).

But in addition to the degree, the level of convergence of the intermesenteric nerves is responsible for some of the variations in the form of the plexus. A high fusion may result, if division below is normal, in an unusually long plexus, and vice versa. This variation will obviously result in varying configurations at the level at which the presacral nerve is resected by the surgeon, with correspondingly different descriptions of the morphology of the plexus based upon the appearance of the specimens removed.

Again, the level of separation of the presacral nerve into its

constituents is sometimes the cause of variations in its form. When this separation is high (and particularly when the level of convergence of the intermesenteric nerves has been low), an extremely short presacral nerve results. On the other hand, when the inferior hypogastric plexûs arise at a lower level than usual, the presacral nerve may reach a length of 5 cm. or more; and all variations occur between the two extremes.

It will be appreciated that these factors account for much of the variation described in the morphological appearances of the superior hypogastric plexus, explaining as they do the occurrence of the (apparently) single "presacral nerve," the narrow and wide "plexiform nerves," and the plexus (Henle's type) of two widely separated intercommunicating nerves. The plexus of several parallel nerves is merely a similar effect due to subdivision of the intermesenteric nerves, while the constituents of the "spider's-web" plexus may be traced to a similar source.

It is, however, with the relative frequency of occurrence of a single presacral nerve that the dissension referred to above is chiefly concerned. The solution here lies almost certainly in two factors. In the first place the condensation of the perineural conective tissue which occurs in preserved cadavers must be considered. There is no doubt that the incidence of apparently single presacral nerves is considerably greater in dissecting-room subjects than in unpreserved specimens (during life at operation, in fresh post-mortem bodies, and in fresh stillborn children and foetûs). This is well illustrated in Fig. 3, and in my own series, in which the percentage of single nerves present in the first group was 25 as contrasted with 10 in the second; and that the explanation lies in the condensation of the connective tissue surrounding two or three separate but closely parallel nerves is definitely demonstrated by close dissection, and by the extreme ease of neuro-dissection in fresh foetûs as contrasted with that performed upon preserved cadavers. In the second place, the degree of dissection which has been taken as standard by different investigators has given rise to much misunderstanding. In a considerable number of cases a superficial cleaning of the superior hypogastric plexus reveals an apparently single broad nerve, which closer dissection easily separates into two or more constituent nerves, each a complete entity. This occurred in 11 of my cases (16 per cent) and is well illustrated in Fig. 4.

In short, age and preservation may convert a true superior hypogastric plexus into an apparently single presacral nerve,

while close dissection may reverse the sequence. It would appear, therefore, that the variations described by different authors are the result of different standards rather than of different observations. The question remains, which of these standards is the one to be accepted? Latarjet claims that the fine dissection which subdivides his presacral nerve exceeds the limits of ordinary anatomical separation, but the comparative ease with which this may be accomplished, as compared with the difficulty in separating a peripheral spinal nerve into its constituents, negatives such a statement almost completely. Furthermore, from the surgical standpoint—and it is here that precise detail is so important—the infrequency with which a single nerve is encountered at operation has been emphasized by almost all authorities, including Cotte himself.

It is, therefore, inevitable that Latarjet's standard must be rejected on all grounds, and that description based upon more complete dissection of the plexus remains the only accurate index of its morphology. (This, however, by no means excludes the advent of a true single indivisible presacral nerve in a not inconsiderable number of cases—see below.) Using this index, my own cases may be classified and enumerated as follows:

VARIATIONS IN THE MORPHOLOGICAL APPEARANCE OF THE PRESACRAL NERVE. (*Personal series—70 cases*).

(*a*) Narrow plexus of two or more parallel nerves ...	22 cases	(31 per cent)
(*b*) True "presacral nerve"	17 ,,	(24 ,,)
(*c*) Wide plexus of parallel nerves	14 ,,	(20 ,,)
(*d*) "False presacral nerve"	11 ,,	(16 ,,)
(*e*) "Spider's-web" plexus	4 ,,	(6 ,,)
(*f*) "Wide plexiform nerve"	2 ,,	(3 ,,)

Taken separately, the nerves removed at operation were arranged in nearly all cases in a complicated plexiform manner. Whether this was the effect of excessive teasing out, or whether it represents a true anatomical picture, it is difficult to say, but one is inclined, in view of the other findings recorded above, to suspect the former of playing a considerable part in the result, which should, therefore, be taken reservedly. Perhaps the same fallacy is responsible for the similar reports of other writers.

Relations of the Presacral Nerve. (Fig. 5).

The nerve lies behind the peritoneum, somewhat to the left of the middle line, upon the bodies of the fourth and fifth lumbar vertebrae, from which it is separated by a dense sheet of fibrocellular connective tissue. This fibrous lamina is easily separable from the plexus throughout the latter's course, and is similarly

separable from the lumbar vertebrae behind, the middle sacral artery intervening between it and the bone in the mid-line.

Below the promontory it rapidly becomes adherent, eventually merging with the sacral periosteum. The anterior surface of the plexus is covered similarly with a finer but still definite layer of connective tissue, the locally condensed subperitoneal areolar tissue. The two laminae fuse at the lateral borders of the plexus, which is thus isolated within a fibrous sheath. This disposition is of considerable practical importance, as it allows of complete extirpation of the plexus without isolation of its constituent nerves or of danger to the subjacent vital structures.

The relation of the plexus to the great vessels varies with the level of the aortic bifurcation and the direction of its branches. In the adult the level of the bifurcation is more variable than is usually appreciated, with the result that the plexus may be entirely pre-osseous or entirely pre-venous, with intermediate variations. As a rule, half of it lies upon the left common iliac vein and half upon the bone.

The pelvic meso-colon with its contained vessels is usually situated completely to the left of the presacral nerve. In some cases, however (Roussel 15 per cent, Cotte 1 per cent, Elaut 8 per cent, Bernard one case, my own series two cases), it transgresses the mid-line (Fig. 6), and lies directly anterior to the plexus, which can then only be reached by incision through the two layers of the meso-sigmoid and dissection between its contained vessels. The left ureter is similarly, usually situated well to the left of the plexus, but in those cases in which the latter is displaced leftwards, it may attain a very close relation.

In a case described by Bernard and Theodoresco, the third part of the duodenum completely covered the promontory. I have never encountered this rare relation, but its occurrence is of importance from the surgical point of view.

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The Basis and Significance of an Anti-spasmodic Control of Labour

BY

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SOME years ago attempts were made to control labour, especially during the stage of dilatation, by the use of anti-spasmodics.[20] Then came the period of stimulation-therapy, based upon pharmaco-dynamic ideas about the physiology of muscle. This involved the far too mechanical point of view that the duration of labour is proportional to the intensity of the pains. Although to-day anti-spasmodic therapy is again slowly gaining general recognition, it is still obvious that the alleviation of suffering stands in the foreground, and that the dynamic-pathological basis underlying the activity of the parturient uterus has been very little investigated.

In what follows we shall briefly summarize how far our ideas have progressed at the Strassburg Clinic since 1923, and to what extent they have produced a physiological foundation for the clinical empiricism of our early days. Justification for the opinions briefly quoted here is to be found in numerous original works.[10–31]

From the mechanical standpoint the progress of labour is dependent upon force and resistance. In the absence of any disproportion, force and resistance during the stage of dilatation are confined wholly to the uterine muscle, and are manifested essentially in the contractile activity of different segments of the uterus. (Schickelé,[37] Kreis[22, 25].)

The effect of the contraction is dependent upon the sum of the anatomical and physiological factors which determine the relation of force and resistance.[25, 27, 31]

Since Goerttler[7] demonstrated the organic unity of the uterine musculature, and since, as a result of his architectural research, function has become an inevitable deduction from previously determined structure, dilatation appears as the manifestation of a change in the framework of the structure, which has been brought about by contraction. The essential changes in the stage of dilatation take place in the cervix and in the supra-

cervical segment of the uterus, where the almost horizontal spiral structure gradually becomes vertical as a result of the uncoiling of the spirals. It used to be assumed that the fact that the upper and lower segments of the uterus contracted in different ways, was a peculiar phenomenon determined by antagonistic or crossed, innervation. That is not so. It is the result of the development of structural changes, in which contraction, originally occurring in a circular direction around the uterine axis, gradually works tangentially, consequent on the verticalization of the muscle units in the lower uterine segment. (Details of structure and of the functions deduced from it can be found in Goerttler.)

Muscular resistance is, therefore, found at the point where the essential changes take place, that is to say, in the cervix. Quite apart from well-known anatomical changes of a traumatic or inflammatory nature, the frequency of which is invariably overestimated, it is still necessary to distinguish degrees of resistance, physiological and pathological in character, which constitute, to a greater or lesser degree, the real obstacle during the stage of dilatation.[23]

From the theoretical physiological standpoint, the necessary change of structure in the cervical and supra-cervical segments constitutes in itself a resistance, but one for which allowance is made in the force of the contraction, and which in practice does not, as a resistance, interfere with the physiological character of force and time in normal labour.

Observation of labour, especially of the stage of dilatation, yields the most diverse results, which, according to our view, have primarily very little or no connexion at all with the various degrees of force inherent in the physical contractions, but with various degrees of pathological resistance.[15, 17, 22, 25]

Schickelé[37] claims to have observed circular contractions, working in the opposite direction, in the lower segments of the uterus as far down as the cervix; Cattaneo[4] has recently demonstrated them graphically. I have continued to look for these so-called spasmodic phenomena in individual cases, and, partly by palpation, partly indirectly by therapeutic measures, have demonstrated their presence, in smaller or greater degree, in the majority of labours.[13, 20, 21, 23, 25]

Although these conditions, viewed from the diagnostic and therapeutic standpoint, give the impression of disturbances of innervation, and were originally interpreted as such by both Schickelé and myself, I have since become more and more

convinced that, taking into consideration the architecture of the uterus as demonstrated by Goerttler, the essential anomalies are in the musculature. In principle, it is a question of arrested structural development during pregnancy, of deficient structural preparation in relation to the date of labour,[15, 24] that is to say, in clinical language, of inadequate and retarded obliteration of the cervix. They must be regarded either as primarily muscular, or only secondarily muscular, and due essentially to adherence of the membrane.

The classical assumption that the cervical canal should persist until the beginning of labour must be rejected, since clinically it cannot be justified.[25] (Kreis.)

This arrest of structural development has a functional significance. It has been shown hysterographically (Kreis,[26, 27, 28, 29] Frey[6]) that when, during pregnancy, the contractions develop into actual labour, the uterus increases the frequency of its periodic contractions, and simultaneously and prematurely increases the tension during the interval. Bearing in mind the anatomical unity of the organ, it seems quite obvious that the tension of the cervix follows the same rule, and is all the more effective since the spirals are still numerous and close together. In other words, the less the cervical canal is obliterated at the beginning of labour, the greater is the resistance during the contractions of labour. This has also been verified by clinical observation, and is manifested functionally in an active constriction of the cervix which can frequently be felt.

Labour, therefore, can be judged neither clinically nor hysterographically according to the amplitude of the contractions alone, without at the same time finding what relation that bears to the general condition of tension and the resistance of the cervix in each case. (Kreis.[26]) Here, however, the purely mechanical view breaks down, because in biological examination the resistance of the cervix is not merely a mechanical ungaugeable factor; in many cases it changes reflexly the type of physical contraction,[14, 23, 37] increases the condition of tension during the intervals, and thereby diminishes the amplitude of the contractions while increasing their frequency. Thus, in spite of an apparent increase in strength, the efficacy of labour is diminished, absolutely as well as in proportion to the increased resistance. According to the above-mentioned clinical observations made by Schickelé and myself, the resistance of the cervix is the real functional hindrance; consequently efforts to overcome this obstacle directly have superseded the customary stimulation

therapy, which was based upon a doubtful judgment of the quality of the contractions, and was undertaken from a purely mechanical standpoint—the greater the intensity or the frequency of the labour pains, the more certain the success.

The clinical manifestation of the above-mentioned muscular discordance is the complex of symptoms which has been described in all essentials by Schickelé. The sacro-lumbar and supra-pubic pain during the periodic contractions, persisting in severe cases even during the intervals, represents the resistance of the lower parts. Reaction against this resistance is manifested by an increase in the labour pains with shortened intervals in irregular pains, or, in other cases, in the increased or irregular duration of the pains. In isolated cases the uterus remains in a state of tonic contraction—the degree of hardness can be felt and differentiated in each case—so that the periodic contractions become small or appear not to take place at all. This gives rise to a false impression of primary inertia, the existence of which we deny. It is always a question of a reactive inhibition, which can often be convincingly proved by the success attendant upon antispasmodic treatment, improvement in the type of contractions, elimination or diminution of the active cervical contraction, and progress of labour. The treatment, which has been developed purely empirically, at first hesitatingly, at the Strassburg Clinic since 1923, has been applied systematically since 1930 in every confinement and is termed *accouchement médical*. It consists essentially of three measures:

(1) *During labour*. (*a*) During the periodic contractions, artificial rupture of the membranes in all cases in which the foetus is lying longitudinally, and whether the presenting part is fixed or mobile, provided that the cervix has been obliterated and even the smallest degree of dilatation exists.[10, 11, 12, 13, 14] In this way any obstacle caused by adherence of the membranes is eliminated. Experience extending over many years has shown us that the membranes, as a hydro-dynamic factor, are of secondary importance, even superfluous, if they are not adherent. (Kreis, publications dealing with this subject.[10–12, 17–19, 23])

(*b*) Anti-spasmodic treatment with spasmalgin (Hoffmann La Roche). This acts with a different intensity in each case.[18] Every artificial rupture of the membranes is immediately followed by an intramuscular injection of spasmalgin (Hoffmann La Roche). Three ampoules are injected during the first hour at intervals of 20 minutes, according to the type of contraction observed before and after rupture of the membranes. Treatment is

not then given for an hour. After that, three more injections are given during the next hour, according to requirements, followed by another interval of an hour during which treatment is not given, and so on. Up to the present, 16 injections are the most that have been given in a single case. When progress in dilatation becomes evident, the intervals between the treatments are prolonged, or the number of injections during the hour is decreased. These measures are based on clinical experience and observation.

(2) *At the end of pregnancy*. Bearing in mind our discovery that the preliminary labour pains, invariably localized in the sacral region, which make their appearance before full time are a pathological prelude to labour (Kreis[16, 17, 22, 32]) and foretell a considerable resistance, these preliminary pains should be treated with spasmalgin (injections or suppositories). This treatment is, at the same time, a reliable clinical test of whether the woman is in labour or not. If the painful contractions cease the woman is not in labour; if they do not cease the woman develops regular labour pains and is in labour. Anti-spasmodic preliminary treatment is indicated in every case of premature spontaneous rupture of the membranes, as this represents a secondary condition associated with the mechanism of obliteration in cases of increased resistance. (Kreis.)

In principle, anti-spasmodic treatment aims at weakening or eliminating the resistance of the active condition of contraction of the cervix; and at preventing, at the same time, the contraction of the uterus as a whole from accelerating its rhythm and increasing the general condition of tension in its efforts to overcome the resistance.

Up-to-date results which extend over several years, some of which have been published, [1—5, 8—23, 30, 32—35, 37, 38, 39] confirm the advantage of routine anti-spasmodic treatment after rupture of the membranes, and the use of spasmalgin. This advantage has been confirmed in the routine practice of an obstetric clinic, by marked shortening of the duration of labour, and also by the marked reduction or almost complete elimination of instrumental intervention, which was formerly necessitated by protracted labour and anomalies of dilatation.

Anti-spasmodic therapy has the further advantage that it can be widely used without injury to either mother or child, and that it renders possible the treatment of each case according to its needs. In this way a genuine control of labour arises, which is grounded on an understanding of the pathological phenomena.

Every obstetrician who knows the helpless feeling which used to be called up by problems of utero-dynamics during parturition, will be able to convince himself, by his own experience and without risk, of the clinical success of this new trend.

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Spontaneous Intrapartum Rupture of the Uterus in a case of Placenta Praevia

BY

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On the 31st May 1934, Mrs. X., aged 34 and pregnant for the tenth time, was admitted to my hospital complaining of slight intermittent bleeding of three days' duration, for which she was treated by her family physician; profuse bleeding on the morning of her admission made her hurry to the hospital. The patient was 36 weeks' pregnant and was due to be confined about the beginning of June. The general condition of the patient was good. On vaginal examination the cervix was soft and admitted the tips of my three fingers. Blood-clots were found in the vagina and a loose lobule of the placenta was presenting at the left and anterior third of the cervical canal. The membranes were intact. The head was presenting in the second position. Labour pains were not present.

At 9.30 a.m. the membranes were ruptured, the vagina was tightly plugged with gauze soaked in a solution of mercurochrome and an abdominal binder was applied. Labour pains soon began and by 11.30 a.m. the patient commenced to bear down and expelled the plug. There was no bleeding.

On vaginal examination the os was dilated to the size of the circumference of a champagne-glass and the head was in the middle of the pelvic cavity. The foetal heart-sounds were good.

By 1.30 p.m. the pains gradually became slow and weak. The uterus was relaxing between the pains. I could not find any abnormal physical sign. The pulse-rate was 120 per minute.

By 2.15 p.m. the patient had a moderately strong pain and very soon after showed signs of collapse. The abdomen was tense and tender and the foetal heart-sounds could not be heard. A vaginal examination revealed that the presenting part had receded and rupture of the uterus was obvious. By the time the theatre

was ready the patient was almost pulseless. A transfusion of saline and glucose was begun and continued throughout the operation. On opening the abdomen the peritoneal cavity was full of blood, the foetus and the placenta were lying free in the abdominal cavity. Although the uterus was well contracted there was considerable difficulty in controlling the profuse bleeding in the left broad ligament. Hysterectomy was rapidly performed and the abdomen was closed.

The patient made a normal recovery and was discharged on the 20th day after operation.

The specimen of the uterus after hysterectomy was examined by Dr. Dhayagude, and he reported as follows:

Pathological report. The specimen consists of a ruptured uterus 16 × 14.5 × 7.5 centimetres (after fixation with five per cent formalin). The left Fallopian tube and ovary are normal in appearance.

A somewhat L-shaped rupture is seen on the anterior wall of the uterus. The vertical limb of the L is placed a little to the left of the middle line and is nine centimetres in length. The short horizontal limb of the L extends to the left broad ligament. The margins of the rupture are gaping, ragged and covered with fibrinous shreds and blood-clots. The lining membrane of the posterior wall of the uterus is smooth. On hemisection the posterior wall is found to be 4.5 centimetres thick and the anterior 3.4 centimetres. The hypertrophied myometrium is pale, but special changes are not noticed.

Microscopic examination. Several sections were taken from the following areas: (1) site of the rupture, (2) posterior wall of the uterus, (3) fundus uteri.

All the sections show hyperplasia and hypertrophy of the musculature of the uterus (common in the gravid condition). A section stained by Mallory's process shows fine fibrosis of a diffuse character. There is no evidence of necrosis, hyaline or fatty degeneration, or haemorrhage in the muscular fibres. The uterine lining in all the sections is devoid of epithelial covering and shows a well marked decidual zone, but chorionic villi cannot be seen.

Considering that the patient had 10 children, the microscopic appearance of the uterine sections did not show any evidence of pathological changes.

The history of the patient. Menstruation commenced at the age of 13 and lasted for five days once a month. She married at the age of 22.

The confinements of the patient were as follows:

Confinement number	Date of confinement	Sex of child	Nature of confinement
1	5th January 1921	Female	Spontaneous
2	1st February 1922	Female	Spontaneous
3	5th January 1923	Male	Spontaneous
4	23rd June 1924	Female	Spontaneous
5	8th December 1925	Female	Spontaneous
6	11th June 1927	Female	Spontaneous
7	5th April 1929	Female	Spontaneous
8	28th June 1930	Female	Premature, at eight months; lateral placenta praevia; version; still-birth.
9	7th November 1932	Male	Spontaneous
10	31st May 1934	Female	Marginal placenta praevia; rupture of the uterus; hysterectomy.

The health of the patient was, on the whole, good. She never suffered from any uterine trouble. She was fairly developed and nourished. She had all her confinements in my hospital and all, except the eighth, were spontaneous. The average weight of her babies was five and a half pounds.

The urine was normal and Kahn's test, taken subsequently, was negative.

This case would appear to be of interest because I cannot find any reference to a similar case in the literature at my disposal.

Discussion. Various causes are supposed to predispose the uterine muscle to rupture spontaneously during labour in a multipara. In Mrs. X's case, however, only the following may be considered: Multiparity, fatty, hyaline, granular, fibrous degeneration and placenta praevia.

Multiparity is supposed to be a powerful predisposing factor; but if we study the reports of several hospitals, we find that although the number of multiparous labours is greater than that of primiparous, no record of any spontaneous rupture can be found. In Bombay, at the Wadia Maternity Hospital, in 25,407 consecutive cases of labour the proportion of multiparae to primiparae was about four to one, and no spontaneous rupture in a multipara has so far been recorded, although many women pregnant for the tenth and twelfth times have been confined at the hospital.

I have personally delivered several women of their tenth, twelfth and fourteenth children in my private practice; and although several of them suffered from inertia and their labours were unduly prolonged, I did not come across a single case of rupture of the uterus.

The great liability of the multiparous uterus to rupture is said to be due to pendulous abdomen and malpresentation. In the case of Mrs. X. the presentation was a second vertex and the abdomen was not pendulous. She was a working-class woman and her abdominal muscles were well developed.

Fatty, hyaline, granular and fibrous degeneration. Much has been said of the conditions. De Lee,[1] Brindeau,[2] and others report fatty degeneration in the muscular fibres, while others attribute the rupture to hyaline degeneration and yet others to the excessive formation of connective tissue. We have, however, not been able to find any of these conditions in Mrs. X's case.

Placenta praevia. Textbooks mention placenta praevia as one of the predisposing causes of spontaneous rupture of the uterus. I have failed to find any reported case of spontaneous rupture due to placenta praevia. Professor Bey, of Cairo,[3] in his article rupture of the uterus, gives a record of 110 cases of rupture of the uterus seen by him during the last 28 years, and compares his series with Merz's series of 160 cases; although the determining causes of rupture are carefully compared in both the series, no mention of placenta praevia as a determining cause has been made.

After reviewing the records of the Wadia Maternity Hospital and the records of my private hospital, for the last eight years, I find that in 25,407 consecutive cases of labour at the Wadia Maternity Hospital placenta praevia occurred 164 times, 0.645 per cent, and in 2,386 consecutive cases of labour at my hospital, 18 times, 0.754 per cent, i.e. in 27,793 cases placenta praevia occurred 182 times. The majority of cases of placenta praevia occurred in multiparae, and in no case was there any kind of rupture of the uterus, or the so-called obstetric shock.

Summary.

1. The case presented is one of spontaneous intrapartum rupture of the uterus in a case of marginal placenta praevia in a woman pregnant for the tenth time.

2. It is of interest because of its rare occurrence in Bombay. Its incidence among consecutive cases delivered at the Wadia

PLATE I.

Maternity Hospital and my private hospital, during the last eight years, is one in 27,793.

3. The obstetric history is of special interest in that there were 10 pregnancies in 12 years. Eight female and two male children were born. Placenta praevia occurred in the eighth and tenth pregnancies. In both these pregnancies the child was a female.

4. The rupture of the uterus occurred during the latter part of the second stage of labour, without any apparent cause and without any premonitary signs of rupture.

5. The rupture of the uterus occurred at the placental site and extended upwards to the body of the uterus and downwards to the left broad ligament (Plate I).

6. Microscopic examination of the several sections taken from the uterine wall revealed changes of no special interest.

I desire to express my thanks to Dr. D. G. Dhayagude, Professor of Pathology, G.S. Medical College, for the pathological report of the uterus, and to Dr. Aroskar, our Resident Medical Officer of the Wadia Maternity Hospital, for his valuable assistance in reviewing the records of the hospital.

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Our Efforts to Improve Obstetrical Results

BY

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NUMEROUS physiological as well as pathological problems await solution in the theory of obstetrics; on the other hand, superficially, at any rate, operative midwifery does not appear to offer any new problems. Its field of application and indications does not extend to any distance, and is rather circumscribed. In this branch of obstetrics essential innovations are hardly to be expected, although now and then new methods, instruments, and technical manoeuvres of minor importance are propounded. These, however, do not alter any of the principles which have been settled during the course of decades, and merely represent slight improvements in the carrying out of certain operations. It is therefore, not unreasonable to find that Max Hirsch's[1] statement "that the practical results of obstetrics show no changes during the last thirty years," should cause a revolutionary stir. The remedy suggested by Hirsch for this cheerless fact was that every case which threatened to become anomalous should be terminated at the very commencement by Caesarean section. In this way operative midwifery would resolve itself into Caesarean section, deep midplane, and low-forceps applications.

I do not wish to dwell upon the merits of this concept of Hirsch, as this has already been done frequently with the ultimate almost unanimous rejection of his suggestion, at least in its original form. A detailed consideration of the results of our obstetric activities is, however, essential to find out whether there is any improvement in our results or not, and to discuss the question of improving the principles of so-called classical obstetrics.

If we compare the results of a maternity clinic in retrospect, doubt arises whether any improvement is not solely due to the increased frequency of Caesarean section at the present time. If this be not true, then an attempt must be made to improve our results by vaginal operations and also to consider the question of extending the indications for certain obstetric manoeuvres.

The most rational basis upon which to judge the activity of an obstetrician is a comparison of his maternal and foetal mortality and morbidity, always providing that the pregnant material is of about the same quality. This cannot be expressed in absolute figures, because, for example, such conditions as maternal deaths caused by severe eclampsia, or deaths of premature children, demand an entirely separate consideration. In these cases the results are greatly influenced by circumstances quite beyond our control. To this class also belong those fortunately rare cases of foetal death which occur during the stage of cervical dilatation. Termination of labour in these cases is frequently fraught with difficulties, for undertaking the risk of Caesarean section in the interest of a problematical foetal life often seems objectionable.

The situation is quite different in the second stage of labour, as its termination is simpler, for when the necessity for completing the labour arises, the obstetrician may choose the most adequate operation, be this *via* the normal parturient canal or outside it. Through the parturient canal a live child can be delivered by means of the forceps or by extraction, or rarely by hebosteotomy or symphysiotomy. The number of extractions does not depend so much upon the judgment of the obstetrician and his concepts of the field of indications—except for those rather rare cases of extraction after podalic version—as upon the ratio of breech presentation coming under his care. Of course, this is not intended to apply to extremists in favour of podalic version, for the principles underlying the point of departure and the concept of this paper refers only to classical obstetrics.

In the case of the forceps, when the establishment of the indications depends solely upon the concept of the obstetrician, the situation is quite different, and an examination should be made on the basis of indications and frequency of the forceps operation, respectively, likely to yield the best results. This has been dealt with by several authors. Thurn-Rumbach[2] and Salacz[3] made statistical compilations on the basis suggested by Mayer[4] and Lönne and Sunkel.[5] Mayer[4] compared the frequency of forceps-applications with the total foetal mortality of babies weighing over 1500 grm. and measuring more than 35 cm., excluding those which died before admission, or during birth outside the clinic. Lönne and Sunkel,[5] on the other hand, took into account the deaths that occurred outside the clinic. These figures, I feel, do not help in elucidating the problem. In the first place, foetûs of 1500 grm. and even heavier are not generally delivered

by means of the forceps. Obviously, also, instrumental delivery is not indicated for small or macerated foetûs. Secondly, syphilitic foetûs are common, chiefly in cities, and this will modify the statistics if compiled in the above-named manner, because they will tend to depend rather on the material than upon the activity of the institution concerned. A third shortcoming of the statistical methods of the authors mentioned above is the fact that they fail to take into consideration the babies which die after the first 24 hours following delivery. It is well known, and also found by us (Table I), that many children die on the fourth and fifth day after birth as a result of intracranial haemorrhage and aspiration pneumonia, both circumstances having a causal connexion with the conduct of labour, or with the operations performed.

TABLE I.

Number of live-born children dying after birth.

Year	1912	1913	1925	1926	1927	1928	1929	1930	1931
Within first 24 hours	6	12	6	7	11	6	3	5	3
Within 8 days ...	18	20	15	8	6	7	15	7	9

Since delivery with the forceps is generally undertaken only with mature children and but rarely on the premature, we compared the forceps-frequency with the number of mature children dying during delivery with, or after the application of, the forceps, or during or after spontaneous delivery respectively. The latter must be considered, because if the children died of intrauterine asphyxia, cerebral haemorrhage, or aspiration pneumonia, they belong to the cases in which the life of the child could probably have been saved had the correct operation been resorted to at the right time.

On the basis of these principles I have compiled the material, for nine years, of the first Women's Clinic of the University of Budapest, consisting of 16,670 cases of labour. Our material is taken from two pre-war years and the last seven years, which are especially suitable for the purpose, because the frequency of delivery with the forceps has undergone great changes in the course of years (Table II). The purpose of these statistics was to establish the value of delivery with the forceps on a proper basis, and to estimate the influence upon foetal mortality of the frequent delivery with the forceps.

TABLE II.

Year	1912	1913	1925	1926	1927	1928	1929	1930	1931
Number of forceps operations ...	38	49	109	72	93	100	77	106	121
Percentage ...	1.88	2.34	5.74	3.78	5.23	5.81	4.47	6.21	6.6

The change is still more conspicuous if the pre-war years are compared with the figures of the last seven years. This alteration may partly be accounted for by the fact that owing to the changed conditions of life, the numbers of elderly primigravidae have increased by 100 per cent. With them, of course, operative termination of labour is naturally more frequent. This fact alone does not, however, sufficiently explain the great change. This is rather to be ascribed to the more universally reserved attitude to employing the forceps in former years, in which our clinic also shared. In more recent times the 2 to 2.5 per cent frequency rose above 4, and even reached 6 per cent.

I should like to stress the fact that the rate of applying the forceps when the head of the child is at the inlet of the pelvis remains unchanged. In 1912 it was 0.19 per cent, and during the last three years 0.3 to 0.4 per cent, so that the increase in the use of the forceps concerns almost exclusively midplane and outlet applications. Nowadays, in the epoch of Caesarean section, this operation is more frequently resorted to when the head shows a tendency not to pass through the brim rather than to subject the child to the danger of trying to deliver with the blades of the forceps above the brim, with the prospect of an eventual perforation of the head of the child. I insist on emphasizing this because such an application of the forceps is a dangerous intervention, while, on the other hand, the forceps applied at the midplane and outlet of the pelvis, in the hands of the experienced obstetrician, may be considered perfectly safe.

With an increase in the use of the forceps the question of justification for the extended indications must arise. To be able to comment upon these problems one must be familiar with the results obtained and obtainable. At the present time the ancient concept, proclaimed rather than resorted to, that the aim of obstetrics was to save both the mother and child, is steadily gaining approbation. On this account, in the future, more operations will be carried out in the interest of the child. A fact borne out by the universal increase in the number of Caesarean sections at the expense of the diminishing number of destructive

operations on the child. In our clinic, for example, the number of Caesarean sections rose from 0.34 per cent to 2.02 per cent. The perforations dropped from 0.28 per cent in 1912 to 0.05 per cent in 1930 and 1931.

TABLE III.

Year	1912	1913	1925	1926	1927	1928	1929	1930	1931
Caesarean Section.									
No. of operations	7	5	13	14	22	25	28	27	37
Percentage ...	0.34	0.24	0.68	0.75	1.25	1.45	1.63	1.58	2.02
Perforations.									
On dead children	13	9	6	15	6	11	11	6	9
Percentage ...	0.62	0.44	0.31	0.84	0.34	0.64	0.64	0.36	0.62
On living children	6	2	4	0	2	1	2	1	1
Percentage ...	0.28	0.09	0.21	0.0	0.11	0.05	0.11	0.05	0.05

The figures for perforation of dead babies are not so contrasting, probably because this is the only treatment for confirmed foetal death on arrival at the clinic. Perforation has become a rare operation (0.36 per cent in 1930) because labour is now terminated earlier, even if resort has to be had to a major operation. This has its significance, too, as it points to there not being any excuse even for perforation of dead children because many of the foetûs die while under observation by the obstetrician, and if the right treatment be adopted at the correct juncture a majority of these children could be saved.

Operations performed in the interest of the baby's life are only justifiable when they succeed in so doing. Let us, therefore, review the results of the use of the forceps with special reference to foetal mortality.

TABLE IV.

Number of foetal deaths in connexion with the use of the forceps.

Year	1912	1913	1925	1926	1927	1928	1929	1930	1931
Deaths during operation ...	4	1	6	1	0	6	4	1	2
Percentage ...	10.52	2.04	5.5	1.38	0	6	5.19	0.94	1.64
Deaths within eight days ...	3	7	2	2	2	2	6	6	6
Percentage ...	7.39	14.29	1.83	2.77	2.15	2	6.79	5.66	4.6

It becomes apparent that infantile mortality, both during and after the use of the forceps, is inversely proportional to the frequency of its application. Thus with the use of the forceps of

1.88 per cent, 10.52 per cent, 6.21 per cent, and 6.6 per cent, only 0.94 per cent and 1.64 respectively died.

If intracranial haemorrhages were directly due to the application of the forceps, the increased frequency of their use should result in an increased foetal death-rate; which is, of course, not borne out by the figures, and, is further proved to be incorrect by the fact that the foetus that died following a prolonged wait, before the use of the forceps, is included in the figures. Foetal death will, therefore, be of still rarer occurrence should the unfounded aversion of obstetricians to early application of instruments be overcome. The results relating to neonatal deaths are similar, viz., with the increased frequency of the use of the forceps, fewer children die within the eight days after their delivery. As has already been shown, intracranial haemorrhages occurring following delivery with the forceps are attributable to intra-uterine asphyxia and the delay during labour necessitating interference rather than to the operation itself.

At this stage it is interesting to study the percentage of foetal deaths during and after spontaneous delivery.

TABLE V.

Number of foetal deaths during and after spontaneous deliveries.

Year	1912	1913	1925	1926	1927	1928	1929	1930	1931
Number	29	29	27	19	19	18	23	12	10
Percentages ...	1.43	1.39	1.42	0.78	1.07	1.03	1.33	0.68	0.61

It can be stated that in the years showing a lower use of the forceps a great number of children died during and after spontaneous delivery. With a 1.88 per cent delivery with the forceps 1.43 per cent died, while with a 6.6 per cent frequency only 0.61 per cent died.

Table VI summarizes the results of the foregoing Tables and shows the total number of deaths during and after (within eight days post-partum) spontaneous delivery and delivery with the forceps.

TABLE VI.

Total number of foetal deaths (mature children).

Year	1912	1913	1925	1926	1927	1928	1929	1930	1931
Number	36	37	35	22	21	26	33	19	18
Percentage ...	1.74	1.77	1.65	1.15	1.13	1.51	1.92	1.11	0.98

In our opinion this Table offers a basis for deciding whether foetal mortality is influenced by the frequent use of the forceps,

and also directs us towards the nature of this influence. From an examination of the Table it at once becomes apparent that the increased incidence of delivery with the forceps is accompanied by a diminution of the mortality among full-time children. This is not a mere trifle, for taking the 220,000 births that occurred in Hungary during 1930, this 0.7 per cent improvement would have meant a survival of another 1,760 children. Even with the material at our own clinic the difference could not be overlooked as it means 14 more children have been saved. Of course, we do not mean to allege that the absolute optimum of the frequent use of the forceps must be the frequency which yielded the results in our hands. Nor do we wish to suggest an exaggerated increase of delivery with the forceps for the purpose of obtaining better results. We only wish to draw attention to the indisputable fact that more babies will die if delivery with the forceps is restricted by the strictly classical indications, than if low midplane and outlet forceps application—entirely safe in experienced hands so far as the mother is concerned—be employed earlier.

If the forceps be applied only after careful consideration of the cases, it has to be allowed that there is at times difficulty in establishing indications for their use. This is better appreciated if the cases are considered in retrospect. Sometimes it grieves us to find that the operation was unfortunately performed too late, while in others we obtained the impression that we should have waited longer. The greatest difficulties arise with foetal indications and among these is the recognition of intra-uterine asphyxia.

Firstly, I should like to mention the problem of what course to pursue when the liquor amnii is stained by meconium. Our conviction, that meconium-staining of the liquor amnii in itself is not an indication for delivery with the forceps, has grown steadily stronger. In most cases we find that this circumstance alone—provided that the foetal heart-sounds remained good—does not impair the chances of the child's surviving, although some considerable time may elapse before delivery. This sign must not be regarded as of no consequence, but rather as a call for more careful observation of the foetal heart-rate. Should this become impaired, or show fluctuation in quality, intervention is called for, especially if the liquor amnii becomes oily as the result of its high meconium-content.

The second problem is that of the foetal heart-sounds. Their frequency, strength, eventual murmurs and their rhythm should be considered. Difficulty in their interpretation has been experienced by every trained obstetrician. Not infrequently a

vigorous child is delivered following observation of poor heart-sounds, while at other times, with only impairment of the heart-sounds, the child is born in a state of deep asphyxia. These circumstances induced us in later years to pay especial attention to the observation and interpretation of the foetal heart-sounds. Without going into details, I should like to mention that, although it is not expedient to wait until the heart-sounds have become entirely bad, in our experience arrhythmia of the heart-sounds does not necessarily indicate asphyxia of the foetus. This applies to those cases of arrhythmia unaccompanied by slowing of the heart-sounds. In our first case referring hereto, arrhythmia of the type just mentioned was observed during the first stage. Conditions for terminating labour *per vaginam* were not fulfilled, and we were disinclined to undertake Caesarean section in the interest of a problematical foetal life as evidenced by the arrhythmia. The heart-sounds did not show further change during the course of labour, and we followed an expectant course. Spontaneous delivery of an entirely healthy, vigorously crying baby occurred. The heart-sounds of the child were arrhythmic on the following morning, although all other manifestations of life were normal. Six months later the arrhythmia had disappeared, thus excluding congenital heart disease. Since this time we have observed two further similar cases, illustrating the delicate differences that have to be taken into consideration.

The situation is quite different if the cervix uteri is being taken up slowly, after a long labour, or if in a case of contracted pelvis the greatest diameter of the head has finally passed the inlet and reached the pelvic cavity. Not infrequently here the observer will be alarmed to hear the heart-sounds become irregular, imperceptible, or slowed, when a moment before they were perfectly normal. No matter how soon the forceps is applied in these cases, extraction at times results in a stillborn, or grossly asphyxiated, child which may not recover. These foetûs succumb, after having successfully withstood the greatest dangers, in the short remaining distance which they have to traverse in the parturient canal. In our opinion one should not wait until the heart-sounds have become very bad in these cases and resort to the forceps.

Indications for the use of the Forceps in the Interest of the Mother.

Opinion seems to be more uniform for the indications of using the forceps in the interest of the mother, although there are

exaggerators in this field too. Expectancy in a four to six hours' expulsion is just as wrong as is the so-called "rescue forceps" (Erlösungszange). In our opinion the optimum attitude is one of compromise. If the head is in the cavity or at the outlet, and does not show any tendency to advance in spite of good pains, there is no justification for further expectancy as the risk of using the forceps when the head of the child is low down, or at the outlet of the pelvis, are much less than the danger of possible or even actual complications, such as injury to the mother or intracranial bleeding in the stagnating foetal head. In our experience we can conclude that a justified moderate increase in using the forceps resulted in diminished foetal mortality. This is shown not only by the ratio of total mortality to the frequency of using the forceps but also in both Tables concerning foetal mortality during the application of the forceps compared with spontaneous delivery. As there is no uniformity in the different years we do not conclude that the greater the incidence of the use of the forceps the better the results obtained, but only desire to state that a too parsimonious use of the forceps is likely to be followed by less favourable results.

So far, all the possible deductions have not yet been drawn. It is obvious that foetûs are lost even with a more frequent use of the forceps. When these cases are more closely investigated the fact becomes evident that the greater number which died in the first days of life did so following spontaneous delivery.

The most frequent causes for the death of mature children are intracranial haemorrhage and broncho-pneumonia. Both complications are chiefly the outcome of delay in labour. In the case of intracranial haemorrhage the cause is either that the foetus is not strong enough to withstand the birth trauma or that the trauma is too severe, as, for example, in the case of contracted pelvis or in delay caused by rigid soft parts. Thus it should be possible to save the foetal life by terminating labour as soon as the head has reached the pelvic cavity or outlet and the cervix is fully dilated. Impairment of the heart-sounds should not be awaited.

An examination of the case-histories reveals that a number of children are still lost as the result of intracranial bleeding even after the above methods are employed. It is, therefore, necessary to consider whether Caesarean section should not be given earlier consideration. This does not mean to suggest that the operation should be performed with an exaggerated frequency, and we shall still only carry out the procedure after düe deliberation. In cases

of contracted pelvis, however, expectancy should not be persevered with for as long as before, although the child may pass the brim of the pelvis it not infrequently succumbs during the first week of its life as the direct outcome of severe birth trauma. The obstetrician should not wait too long to see how much the pains and moulding of the head will accomplish. Resistance of the soft parts must also be taken into account, although this factor has been considered in the past.

That we are conservative is shown by the number of Caesarean sections carried out, viz. 1.5 per cent to 2 per cent, a figure which includes all the cases operated upon, following the present-day indications such as heart disease, prolapsed cord, and placenta praevia. Nevertheless, the number of Caesarean sections which we perform is rising. This we feel is quite justifiable as the operation, in our hands, has proved fairly safe. There has not been any fatality in the last 117 cases, although several parturient women were admitted to the clinic with raised temperatures and ruptured membranes.

Summarizing our experiences we must conclude that the indications for the application of the forceps need revision and, as is obvious from our material, better results may be obtained if the operation be carried out more frequently and the indications made more liberal—this conclusion we arrive at following a serious and scientific review of our experiences.

Still better results will follow if Caesarean section, in suitable cases, be resorted to earlier than has been the custom hitherto.

A more serious consideration of these deductions is forced upon us, because the obstetric results obtained so far cannot be called ideal, and also the number of elderly primigravidae is steadily increasing following upon the changed social and economic conditions. These women should not be subjected to "trial labour." Even less so when it is realized that the overwhelming majority of gravidae of to-day are obliged to work and, therefore, have to suffer the inconveniences and disadvantages of their pregnant state. It is our duty, therefore, to attain, or at least approach within the boundaries of human possibilities the real aim of obstetric activity, to save the life of both mother and child.

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A Case of Eclampsia (1933)

BY

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THE case I report has an important bearing on the following *considerata*:

1. The treatment of the case was based on the belief that bio-physical forces are the cause of the disease.

2. Such an aetiology was indicated by the fact that the patient was a primigravida, and the smallness of her pelvis. That she was short in stature was an additional indication.

3. The late occurrence of the disease in the pregnancy strengthened the opinion, as did the history, that up to the onset of her illness, the patient, previously perfectly well, had been continuously active.

4. The occurrence of the case in summer was interesting. Since climatic changes, apart from their effect on striated muscles (e.g. of the abdomen), affect the volume of the blood sent to the skin and to the viscera respectively, in a reciprocal fashion, the seasonal variation of eclampsia would seem to support the bio-physical conception of the disease.

5. The opinion was further supported by finding that the pressure in the rectum, the patient lying on her side, was considerably greater than in the normal non-pregnant woman; and that the pressure had reverted to normal after the uterus had been emptied.

6. That the pressure so found before the delivery was not due to the visceral weight was demonstrated by measuring it during spinal anaesthesia. With the patient persisting in Sims' position and the foot of the bed on blocks, the pressure gradually fell until it became markedly negative. As the effect of the drug wore off, the pressure rose to its original level, the patient remaining in the same position.

7. This also demonstrated that the pressure in the rectum was but little influenced by the musculature of the gut. Since spinal anaesthesia is associated with activity of visceral muscle, it was feared the fall of pressure, due to the weakening of the muscles

of the abdominal wall, would not be shown. The reverse was the case. But a reaction of the gut apparently occurred from 5.08 p.m. to 5.16 p.m., during the observation. During this period, initiated by a feeling of nausea, the intra-rectal pressure was less negative than immediately before and immediately after.

8. It is not affirmed that the spinal anaesthesia prevented the further appearance of fits in this case: it may have been so. It is certain that the tropococaine, injected into the spinal canal, in doses hitherto given, was insufficient to affect the state of the kidneys. But in this respect cases of eclampsia must be divided into those in which the renal malfunction is produced rapidly, and those in which it has been of some standing—as in the case reported. In the latter a larger dose seems necessary. On this point further observations are required.

9. Caesarean section acts by diminishing the intra-abdominal pressure and reducing the demands on the kidneys, liver and heart. In many cases of pre-eclampsia and eclampsia, it is followed by rapid restoration of the patient. In such cases one must believe that the kidneys are not fully distended at the moment of operation: thus after the operation they can distend further. In other cases the renal malfunction persists or becomes worse: in such it seems that the kidneys are already maximally distended, so that after operation the tension of their capsules prevents further expansion; thus the vicious circle is maintained. If the volume of the blood is not sufficiently reduced by the operation the vicious circle is aggravated.

10. In cases of persistent post-operative grave renal malfunction, venesection appears a valuable remedy. Since such rapid restoration of renal function followed in the present case, the albumin falling from 12+ to 0.75, Esbach, in 24 hours—and a similar response has occurred in some others—venesection can only be supposed to act physically.

11. The lateral position, persistently maintained, so valuable in treatment, has a much more profound effect than preventing the eclamptic patient from drowning in her secretions. Naturally it also only acts physically.

12. The importance of a correct aetiological conception is reflected in the results. Conversely, the successful issue of the case, as of others similarly treated, supports the attitude forced by the evidence.

On Tuesday, July 4th, 1933, a Mrs. R., suffering from eclampsia, was admitted to St. Cross Hospital. Though the latter part of June had been stormy and at times chilly, the last few days had been very hot. The few

cases of eclampsia admitted to our hospital have usually appeared either in the spring or more commonly in the early autumn—not in hot weather. After leaving home the patient had no further fit, although she had been brought a distance of seven miles. The case was a mild one, in spite of a little postpartum difficulty.

Dr. Bradley, of Lutterworth, kindly furnished the following notes. The patient, a primigravida of 28, short in stature—four feet eleven inches tall—with pelvis rather smaller than normal, was first seen by him on May 4th. She expected to be confined on August 6th, and did not complain of anything. On June 3rd the urine did not contain any albumin. It was arranged she should be examined in a month's time to ascertain the relative sizes of the foetal head and the maternal pelvis. But on June 29th headache and puffiness about the eyes appeared, the ankles were swollen, and the urine was loaded with albumin. The patient was sent to bed, and put on fluids and saline aperients, with citrate of potash. Meat, fish and eggs were forbidden. On July 1st the amount of albumin was still the same, in spite of the diet and free bowel evacuation; there were not any ophthalmic symptoms or vomiting. On July 3rd the amount of albumin was still great and the headache persisted. On July 4th an urgent call was received at 6.30 a.m. The patient was in a fit, which lasted an hour. After a short interval she had a second fit, and then was sent to hospital.

Shortly after admission (7.50 a.m.) a quarter of a grain of morphia was given, an enema administered, and a catheter passed. At 10.20 a.m. spinal anaesthesia, without chloroform, was induced. I saw the patient at 11.30 a.m.; she was quite conscious, but complained of headache. Oedema was general but not marked; the urine was loaded with albumin. She told me that up to her illness she had been busy in the house and had eaten well. She was about eight months pregnant: the foetal heart was heard. The blood-pressure was 170/110. The pressure in the rectum, the patient being in Sims' position, was 16 mm. Hg.; and 26 mm. Hg. when lying on the back—both considerably higher than in the normal non-pregnant woman. The treatment consisted of inactivity, quietness, no food, restricted fluids. The patient was kept in bed well over on her side; fluids—sodium bicarbonate solution and glucose—were limited to one pint, in all, per 24 hours.

In the afternoon the condition was unchanged. There had not been any further fit. The blood-pressure was 160/88. It was decided to induce spinal anaesthesia again; it was hoped an improvement in the renal function would follow. This was done at 4.30 p.m. The pressure in the rectum was continuously observed from 4.30 p.m. until 7.15 p.m. I watched the manometer myself until 5.45 p.m., and then a nurse took my place. During the whole time the patient was lying well over on her side; and except for raising the arm occasionally, which immediately affected the pressure, she scarcely moved. At the outset the foot of the bed was raised on blocks, and the pressure in the rectum, which at first was 16 mm. Hg., soon settled down to 12 mm. Hg., possibly due to this cause. As the tropococaine began to take effect the pressure gradually sank and became negative, the greatest negative pressure registered being −7 mm. Hg. At the end of an hour and a quarter it had risen to zero, and from then on it

gradually rose higher, reaching 11 mm. Hg. again. On my return at 7.15 p.m. I confirmed the manometric reading. There had not been any interference during my absence, the patient was still lying well over on her left side, and the foot of the bed was still on blocks.

The next day (July 5th) the patient's condition was much the same. The tropococaine had had no appreciable effect either on the output of urine or on the albuminuria. The same general treatment was continued—Sims' position, foot of bed on blocks, no food, liquids restricted, an enema given. On July 6th the condition appeared still unchanged. The output of urine was small, the content of albumin great (8, Esbach), the blood-pressure high (170/120). A further attempt to break the vicious circle was now made. At 2 p.m. lower segment Caesarean section was performed under spinal anaesthesia, but this proved insufficient for the operation and general anaesthesia had to be induced. A living child, weighing 5 pounds 6 ounces, was delivered. Neither kidney was decapsulated. Pituitrin was carefully avoided.

The next morning (July 7th) the patient's state appeared but little altered. The output of urine since the operation had been small; the content of albumin, if anything, was greater (12+, Esbach). The blood-pressure was still up (145/105). The reply to this persistence of renal malfunction was a venesection. The amount of blood lost at the operation —an important point—if small, as is usual with spinal anaesthesia, leaves the patient with a relatively too great volume of blood, since the placental circulation is abolished—the uterus having become a "blood-tight" organ (Longridge). If the mechanistic conception is correct, such a state must tend to maintain the turgescence of the renal medulla, demonstrated in 1929, the associated and consequent blockage of the uriniferous tubules, and the tightness of the capsule investing the organ resulting from this state. With such a picture in my mind, 15 ounces of blood were allowed to flow freely without any immediate effect. During the afternoon the state of the patient, *qua* renal output, appeared unaltered; but the morning after (July 8th) the condition was different. The albumin had dropped to a trace (from 12+ to 0.75, Esbach), and the output of urine had become greatly increased. The blood-pressure, however, was still raised (150/110).

On July 9th—that is, two days after venesection and three after the Caesarean section—the patient had a rigor, the temperature rising to 106°F. This rigor, however, was not repeated. On July 10th the temperature remained at about 99°; it wavered between there and normal for the next week; the wound healed without trouble. On July 16th the blood-pressure was given as 132/75. The intra-rectal pressures were again observed on July 17th. They were as follows: Knee-chest, –2 mm. Hg.; left side, 4 mm. Hg.; back, 10 mm. Hg.; standing, 18; left side again, 8 mm.; flat on back, 12 mm. Hg. The patient was discharged on August 12th with a faint trace of albumin in the urine, and a living child.

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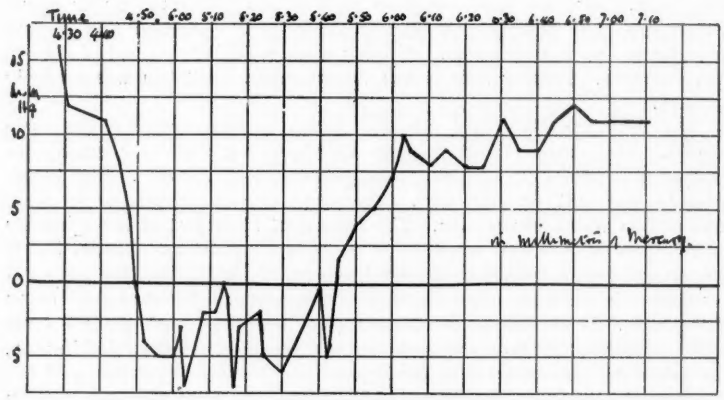

Graph showing the effect of tropococaine on the intra-abdominal pressure. A thin finger-stall, containing some air, and attached to a mercurial manometer was inserted into the rectum. The patient was placed in Sims' position and kept in that position throughout the observation. At the outset the foot of the bed was raised on blocks. As the tropococaine began to take effect the pressure fell; as the effect of the drug wore off the pressure steadily rose. The temporary elevation between 5.08 and 5.16 was associated with some visceral activity, as marked by nausea.

Changes in the Ovaries of Pregnant Women and Female Rabbits as a result of Auto-reaction of Zondek-Aschheim

BY

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CLASSICAL works of Zondek and Aschheim[1] on the action of the anterior pituitary body form the basis of the sexual endocrinology. These authors have stated that the action of the ovary is regulated by the hormone of the anterior pituitary body. Our viewpoint on this subject has, however, considerably changed since the year 1930, when the first Zondek-Aschheim[1] publication, "Diagnosis of Pregnancy in Urine," appeared. Since this time it has become evident that the role of anterior pituitary body is far more complex than Zondek and Aschheim[2] at first supposed. Long and Ewans have stated that the anterior pituitary body regulates the normal growth of the organism. But this is not the only role of the anterior pituitary body. Almost all the endocrine glands are under its influence.

Studies of Anselmino,[3] Hoffman,[3] Herold,[3] Abelin,[4] Smith,[5] Uhlenhuth,[6] Loeb,[7] Aron,[8] Wahl,[9] Verzar,[9] Paal and others have demonstrated the immediate relation of the thyroid, parathyroid, suprarenal glands, and the islands of Langhans of the pancreas with the anterior pituitary body. It would lead us too far to discuss here the whole activity of the anterior pituitary body; we shall pay our attention only to its gonadotropic action. The last question is also not entirely elucidated. There are many theories and few facts. According to Abelin " we ought to depend only on clinical and experimental observations and not to increase the reigning disorder by creating new theories and hypotheses."

Since the year 1930 we have collected clinical observations concerning this subject. In the year 1931, together with Halber and Pruszczynski[15] we described in the Polish Gynaecological Society the changes in the ovaries of rodents after prolonged

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treatment with the hormone of the anterior pituitary body. In the year 1932 the results of our investigations were published in the *Monatschr. f. Gynäkol.* In this work were experimentally demonstrated the great changes which occur in the ovaries after numerous injections of preparations containing prolan (anthypophysin choay, prolan bayer, suspension of chorionic villi of fertilized ovum and placenta). This result could be expected when taking into consideration the small quantities of urine of pregnant women which cause ovulation of immature white mice. We wrote then: "It is possible that during pregnancy the excess of hormones in the circulating blood in women causes retrogressive changes in the ovaries." This supposition was based on a fact we observed in one female rabbit, the pregnancy of which was only accidentally started. The animal showed marked changes in the ovaries. In order to repeat this observation we started systematic examination of the ovaries of pregnant women and female rodents. In the literature there are but little data concerning the changes in women during pregnancy. Kehrer[10] in *Biol. d. Weibes*, and Neumann[11] in his recently published monograph "Methods of Morphological Examination of Ovaries" (1933) pay but little attention to this question, describing more in detail only corpus luteum graviditatis. We know from these works that the ovary during pregnancy becomes larger, the proportion of its length to its width is approximately 3–5 cm. to 1.5 cm. Kehrer[10] does not agree with Briere de Boismont (1872), Strassmann, and others, who say that the ovary during pregnancy is in a state of rest. On the other hand, it has been only partially confirmed that during pregnancy the normal ripening of Graaf's follicles occurs. Keller,[12] Leitz[13] (1908), R. Meyer[14] (1932), R. Schröder (1915), observed that during pregnancy under the influence of the fertilized ovum the ripening of Graaf's follicles takes place, but only to a certain extent; when the follicle reaches the dimension of a pea it undergoes atresia. The influence of hormones in the circulating blood upon the ovaries during pregnancy, as we may see, was up to now not sufficiently elucidated. We wanted to throw some light on this subject by way of clinical observations at operations in which the peritoneal cavity of pregnant women was opened, as well as by experiments on female rodents. The best material for these observations proved to be the ectopic tubal pregnancy: (1) In these cases we have always to deal with an early period of pregnancy, when the organism contains the maximal quantity of sexual hormones; (2) the ovaries are more accessible to the eye than in other cases, such as tumours in the peritoneal

cavity. Since the year 1931 we have had the opportunity to examine the ovaries in 10 cases of ectopic tubal pregnancy. These were partially our own patients and partially those of our colleagues from the Clinique Maternité.

In order to eliminate the influence of continual changes of the Fallopian tube on the ovary, we examined exclusively the ovaries on the healthy side. Our material, being rather modest on account of number of cases, is totally uniform as regard the results. In all the cases we found enlarged ovaries, marked haemorrhagic spots in Graaf's follicles—reactions which are most characteristic for pregnancy. In all these surgical cases microscopic examination could not be performed, and, therefore, we resolved to fill the gap by way of experiment.

Through the kindness of Prof. L. Hirszfeld we have begun, in the State Institute of Hygiene, a series of experiments on pregnant rodents. The choice of the animals for the experiments plays an important role. The pregnant guinea-pig proved to be inadequate because the ovaries are small and possess a thick membrane so that the changes may be seen only microscopically. Mice are not the proper objects, because of the hyperaemia of all the organs of the peritoneal cavity, which fact may be the source of some errors. Rabbits proved to be the best material. We selected animals as young as possible weighing 2,500–3,000 grm. The technique was as follows: The operation was performed aseptically with a dorsal cut on the left side of the spine beneath the kidney. The ovary was removed, though a small incision, the pedicle tied with catgut, and the wound was sewn up with a continuous catgut suture. The wound was dressed with collodion. The rabbits stand the operation quite well and pregnancy is not interrupted. We examined 12 pregnant rabbits in different periods of pregnancy. The results in all the examined cases were quite uniform and, therefore, conclusions could be drawn even from this small number of experiments. We noticed most striking changes in the second period of pregnancy in the second and third week, after a longer action of the hormone on the ovaries. Pregnant rabbits revealed changes similar to those occurring in mice and rabbits after the injection of urine of pregnant women. The changes are even more marked because the action of the hormones is longer and more intense. The changes are typical, they may be seen with the naked eye. The ovaries are two to three times larger (proportion of length to the width is as 2.25 cm. to 1–1.25 cm.), their surface is uneven, knobby, deformed, with numerous luteinized Graaf's follicles. Nearly every

ovary showed a follicle with haemorrhagic spots and an increased number of ripening follicles. Summarizing, we may say the ovaries presented all three reactions of Zondek-Aschheim.

The ovaries, fixed in formalin and alcohol, were embedded in paraffin and stained with haematoxylin and eosin after von Giesson's method. They were also stained with Sudan III, after Craccio, for the detection of lipoids. The microscopic examination revealed: (1) Enlarged blood-vessels; (2) haemorrhagic spots in Graaf's follicles and in the pulp of the ovaries; (3) a reduced number of Graaf's follicles in general; (4) a certain number of the follicles show, besides the haemorrhagic spots, some retrogressive changes, cystic enlargement, a small (as if crouched) ovum cell, a number of follicles in the period of ripening, and a very small number of ripe follicles; (5) the connective tissue proliferating around the follicles, causing their atresia and, penetrating between the luteinized cells, divides them into small islands of different size.

The results of clinical observations as well as of our experiments and anatomo-pathological examinations are quite uniform. They allow us to say that in ovaries of women and rabbits during pregnancy the same changes appear which can be found in immature mice or rabbits after the injection of urine of pregnant women. These changes are less marked, then, after numerous injections of hormones of anterior pituitary body, because during pregnancy the action of the hormone is not so intense. All three reactions of Zondek-Aschheim occur in the organism of women and rabbits.

The occurrence of the Zondek-Aschheim reaction in ovaries of pregnant rabbits does not agree with Zondek's statement that an over-production of hormones of the anterior pituitary body is to be noticed only in primates during pregnancy. In order to discover whether the changes we observed in the ovaries are of a temporary character we isolated the female rabbits after delivery (in order to avoid new pregnancy) and four to eight weeks later we took out the second ovary. The changes were no more to be seen. The ovary was small, there were not any haemorrhagic spots, the surface of the ovary was smooth without any corpora lutea atretica, and there were numerous normal Graaf's follicles. It proves the changes were only the result of pregnancy.

The hormones in the circulating blood of a pregnant woman and rabbit have a very vast area of action. There are observations which point to the fact that with the blood the hormones pass to the foetus and, acting on its sex organs, cause changes in the

sense of Allen, Doisy, Zondek and Aschheim. This observation will be the subject of our next publication.

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The Training of Midwives in Rotterdam

With reference to his paper, "The Terms of Admission and the Training of Midwives at the Government Training College for Midwifery in Rotterdam" (see pp. 562–567), Dr. Wesselink has sent the following additional information:

1. There are 70 beds in the Clinic of the Rotterdam Midwives' School.

2. The staff of teachers consists of five doctors of medicine (among whom there are three specialists for obstetrics and gynaecology, one specialist for infant medicine and one 'family doctor'), one head midwife, one head nurse, one lady teacher who at the same time, holds a diploma of theoretical midwife examination.

3. The students of the first annual course of study devote one hour a day to domestic occupations, on an average.

4. The hours of study are regulated according to enclosed time-table, private study being carried on during off-duty time. The students of the first year are off duty every week-end (Saturday afternoon and Sunday); the students of the second year are off duty one Sunday every fortnight; the students of the third year are off duty one whole day every week. Holidays: All pupils have one month's holiday in the summer. In addition the pupils of the first year have two weeks holiday at Christmas and two at Easter. The pupils of the second and third years have one week's holiday at Christmas and one at Easter.

5. During the last month of the first annual course only those pupils who are to move up to the second annual course assist at deliveries.

6. There are no extern deliveries, the number of patients delivered within the Institute being large enough for instruction purposes.

7. Patients progressing normally remain in hospital for 10 days after delivery.

8. We have no women Inspectors of Midwives. The midwives are under control of the Medical Inspector in whose district they practise.

9. Midwives are, with respect to their professional duties, under the control of the Inspector. In addition there is a Medical Disciplinary Board, under the chairmanship of a Doctor of Laws,

which deals with any actions by medical men and midwives which are unworthy of their profession. Penalties are:

1. A warning.
2. A reprimand.
3. The imposition of a fine not exceeding fl. 2,000.
4. The suspension of the execution of medical or midwifery practice for a period not exceeding one year.
5. Removal of the name of such a person from the Medical or Midwives Register.

In case of a verdict as mentioned under 3, 4 and 5, appeal is admissible to the Court of Justice.

CORRIGENDA.

Dr. Wesselink's Paper, August 1934.

Page 564, second line of fourth paragraph. For 48 read 40.

Page 566. Paragraph five should read:

The final examination is held 10 months after the first, in the month of April. Till August the pupils remain attached to the school, but during this period they can act as substitutes for practising midwives all over the country. The practising midwife can return to the school for several weeks' post-graduate experience.

Obituary

BARRY KEYTE TENISON-COLLINS, M.A., M.D., B.C. Camb., F.R.C.S.E., F.C.O.G.

THE sudden death of Dr. Barry Tenison-Collins on the 23rd of September terminates a family association with the Gynaecological Department of Cardiff Royal Infirmary of over 30 years' duration, as his father, the late Edward Tenison-Collins, was Gynaecologist there from 1901 until his death in 1926.

Barry was the younger son and was born in 1887. He was educated at Llandovery College and Trinity College, Cambridge, and attended Middlesex Hospital for his final medical studies. He qualified for M.R.C.S. and L.R.C.P. in 1914, and after holding resident appointments in the Birmingham General Hospital, Cardiff Royal Infirmary and in the Maternity Department of the Hôpital Boucicaut in Paris, he joined the R.A.M.C. (T.F.). In this capacity he saw active service in Gallipoli (1915), Egypt (1916), and in East Africa from that date until the armistice.

After demobilization he returned to Cardiff to work for higher qualifications, and he rapidly obtained the F.R.C.S. of Edinburgh and the M.B., and later the M.D. of Cambridge.

He now settled down to what was going to be his life's work and was appointed Assistant to the Professor of Obstetrics and Gynaecology in the Welsh National School of Medicine in 1921; in 1924 he was appointed to the Junior Gynaecological Staff of Cardiff Royal Infirmary, and in 1931, when Sir Ewen Maclean retired, he was promoted to the Senior Staff.

He was a Foundation Member of the British College of Obstetricians and Gynaecologists and in 1932 was elected to the Fellowship.

With these and various other appointments he was soon established in busy practice in South Wales with the reputation of a sound practical man and an expert operator. His outlook was essentially practical and he had mechanical acuity amounting almost to genius, so that in the infirmary and at home he was

constantly introducing little mechanical improvements, often of the greatest utility.

His contributions to the literature of his speciality were not numerous but were always of merit and included a posthumous paper in the October number of this Journal.

As a colleague he was most acceptable and his cheerful presence was always welcome among his personal and professional friends; while as a teacher he was concise, clear and forceful.

His interests outside medicine were multiple, and first of these to be mentioned must be yachting; every spare moment was spent in his motor yacht in the Bristol Channel, and it was while thus engaged that the cerebral haemorrhage occurred from which he died the following day. Help was difficult to obtain, and it was some hours before he could be got ashore to the infirmary where he died the following morning.

He was also an expert gardener, with a specialized knowledge of rose culture, and the garden at his house at Penylan in the outskirts of Cardiff was very lovely. He was one of the pioneers of wireless reception in South Wales. He is survived by his widow, the daughter of Mr. Brunel White, of Carmarthen, and one daughter. His home life was particularly happy and much sympathy is felt and expressed for Mrs. Collins. It is particularly sad that a man of Collins's promise should have been taken away at the early age of 47, and the news of his death came as a painful shock to a wide circle of friends in South Wales.

His funeral service in the chapel of Cardiff Royal Infirmary on September 27th was attended by practically the entire honorary medical staff of that institution as well as by members of the board of management and many friends.

G. I. STRACHAN.

BOOK REVIEWS.

"Diseases of Women," by TEN TEACHERS. Edited by Comyns Berkeley, J. S. Fairbairn, and Clifford White. Published by Edward Arnold and Co., London. 18/-.

THE fifth edition of this well-known textbook has now been published, and it can be said without hesitation that it maintains its position as one of the leading textbooks on the subject. Without omitting any essentials, the book has been kept simple and easily read, and the illustrations are all extremely clear and apposite. For a book of its size the chapters on menstruation and its disorders are full and they give a readable synopsis of the huge amount of literature which has sprung up round the subject in the last few years.

The subject of uterine haemorrhage has been attacked from a very practical point of view. The discussion of the differential diagnosis is most helpful. The details of treatment should be of great value to practitioners, although the reviewer is of the opinion that too much has been claimed for organotherapy, especially in cases of functional haemorrhage.

Virginal leucorrhoea is stated to be due to erosion of the cervix, and cauterization is advised. This is not in agreement with the most recent work on the subject as the condition is now held to be due, in most cases, to disturbed ovarian function, and local treatment is most unsatisfactory.

In dealing with cancer of the cervix uteri the authors make little attempt to compare the relative merits of operation and radium treatment. Indications are not given as to the results of either method, except the statement of the immediate mortality after operation.

Apart from these minor criticisms, the impression left is that of a very sound, up-to-date textbook, easily read by students and of great practical value in both diagnosis and treatment to practitioners.

Dugald Baird.

"Cancer, Edinburgh, 1934." Published by the Cancer Control Organization for Edinburgh and South-East Scotland. E. and R. Livingstone, Edinburgh.

THIS volume, which is intended as the first of an annual series of publications, contains an exhaustive statistical survey of the results of treatment of cancer in the Royal Infirmary, Edinburgh. It is proposed, in addition, that the annual volume should contain articles of interest to the practitioner and specialist, and also to that section of the laity, interested and well-informed, which offers substantial help to the medical profession in its attack on cancer.

Pages 7 to 12 contain an address by J. J. M. Shaw, F.R.C.S., at the inaugural meeting of the organization in March 1934. In it he describes the main outlines of a scheme for cancer control organization for Edinburgh and the whole of South-East Scotland. The main objects of its endeavour

will be: To encourage and co-ordinate clinical, laboratory and statistical research on cancer; to facilitate the earlier diagnosis and treatment of the cancerous patient; to obtain full information regarding the results of all forms of treatment with the necessary careful and prolonged follow-up in each case; and to assist the National Radium Centre in so far as its services are common to all the hospitals in the area.

Pages 13 to 69 contain a full statistical report on the cases of malignant disease treated at the Royal Infirmary from August 1930, to December 1933, together with details of the methods by which the majority of the treatments had been carried out during that period. A list of the office bearers of the newly formed cancer control organization is appended.

This publication is of great interest. Firstly, it gives details of the development of a very important regional organization for the co-ordination of forces in the fight against cancer. Secondly, it is the first publication which gives detailed statistics of the results of treatment of all patients with malignant disease applying for treatment to one of the great general hospitals in Great Britain. It is only by the publication of a large number of similar statistics that true comparison can be made of the results of various methods of treatment and these methods evaluated. The production of a statistical report of this nature represents a great volume of detailed work, and the authors deserve the highest commendation.

B. W. Windeyer.

"Human Sterility," by S. R. MEAKER, M.D. Pp. xi.+276. Tables 16, Figs. 27. Size 9¼ × 6. Price 18s. (Baillière, Tindall and Cox, London, 1934.)

THIS volume is published by the United States National Committee on Maternal Health. In a foreword by Kosmak and Dickinson, the author is described as the Chairman for Sterility on the Board of Directors, and the present volume as "the most competent text in its field."

The book demonstrates in a striking manner the rapid development which is taking place, more especially in America, in the scientific investigation of sterility. The present author is well known as one of the chief pioneers in this development.

The book discusses in detail the known facts in regard to the aetiology of sterility. The chief conclusion in this respect is that "in the ordinary clinical case sterility is due, not to some one deviation from the normal, but to a summation or totality of several causative factors. Procedure on any other basis leads to incomplete diagnostic study and inadequate treatment, with correspondingly unsatisfactory end results." Thus, in a tabular study of 100 sterile couples it was found that no case showed less than two causative factors, and the average couple showed 4.81 such factors. Meaker points out that even before the days of complete diagnostic study this multiplex causation might have been foreseen from a study of the literature. Thus Bumm ascribed 66 per cent of sterility to female genital hypoplasia, Polak 70 per cent to endocervicitis, Noegerath 90 per cent to gonorrhoea, Mandelstamm 66 per cent to tubal blockage from various causes, another writer 80 per cent to endocrinal disorders, and so on. In his own series of 100 couples Meaker found in the male 161 factors capable of lowering fertility

(108 constitutional and 53 local), and in the female 320 such factors (107 constitutional and 213 local). Thus, about one-third of all causative factors are on the male side, whilst two-thirds are on that of the female. Despite this, as about 90 per cent of both male and female present positive evidence of infertility, it is only in rare instances that the blame can be ascribed entirely to one individual. Thus the usual clinical problem is, therefore, "not that of one definitely sterile partner . . . but rather that of two individuals of whom both exhibit some degree of infertility."

The standard of investigation which Meaker insists upon in all his cases implies a preliminary study of both husband and wife over a period of one week. For this residence in hospital is not necessary. The regular members of the investigating group are a urologist, a gynaecologist, an internist, an endocrinologist and a clinical pathologist. Special consultants outside the regular group are called upon as occasion arises.

There is a full description of the various kinds of investigation carried out and of the lines of treatment which are followed. The therapeutic routine aims at dealing with all the causative factors before failure is admitted. In the average couple, where four or five factors are discovered, those more easily dealt with in general take precedence. At the same time, for example, it would be unjustifiable to subject a woman to elaborate therapeutic measures as long as the husband's semen is conspicuously subnormal. In general, factors of relative sterility give way in order to absolute factors. Moreover as tubal insufflation and lipiodol injection are followed by conception in about 10 per cent of unselected cases, systematic treatment may be postponed for one or two months after the diagnostic study is completed.

In discussing results Meaker concludes from a study of the literature that previous lines of therapy have given success in from 18 to 20 per cent of cases. If we exclude cases in which therapeutic measures were not acceptable or were not instituted because of gross loss of function, the successes rose to about 30 per cent (based upon records published by Polak, Hunner and Wharton, Dickinson and Cary, Macomber, Meaker). In a total of 64 personal cases investigated and treated (36) by the present methods, success followed in 29.7 per cent; and, if 28 untreated cases are excluded, in 50 per cent. The author admits that his figures are still too small to allow of a dogmatic statement.

By way of general résumé we would describe this book as an important contribution to a difficult subject. It should be in the possession of all obstetricians and gynaecologists and those others who are interested in the technical side of the subject. Much of its method is still in the nature of research and is hardly capable of being incorporated into the daily routine of an ordinary hospital clinic until it has been tested and reduced to practical formula. This is especially true of the impressive array of potential factors distributed over both sexes which Meaker's investigations have revealed. At the moment he regards this as justifying the view that sterility usually springs from a summation of several factors. At the same time the evidence is not inconsistent with the view that in any individual case one single factor is usually operating and that the real value of a wide survey is that it reveals by a process of exclusion agencies that in the past have been overlooked.

James Young.

"Obstetric Medicine," by FRED L. ADAIR, M.A., M.D., F.A.C.S., and EDWARD J. STIEGLITZ, M.S., M.D., F.A.C.P. Pp. xvi+743. 24 illustrations, 2 coloured plates. Price 36s. net. (Henry Kimpton, London, 1934.)

THE objects of this work are "to co-ordinate and correlate the medical knowledge concerning the problems of diagnosis, therapy and prognosis of disease occurring coincidently with pregnancy." In the task 39 contributors are concerned, and the plan adopted has been to place the individual subjects, tuberculosis, syphilis, tropical diseases, deficiency diseases, diseases of the lungs, diseases of the heart, diseases of the urinary tract, diseases of the teeth, orthopaedic diseases, and others, as these bear on pregnancy, in the hands of a person who is an acknowledged authority on the subject.

The idea is a somewhat novel one, but there can be no doubt that it has much to commend it. In the ordinary obstetric textbook the diseases incidental to pregnancy and not arising from the pregnant state are apt to receive inadequate treatment in that the obstetrician can rarely pretend to the possession of an intimate and authoritative knowledge of the subjects concerned. Indeed it must necessarily be in general his practice to submit such patients to the care of his medical and surgical colleagues.

The present volume is naturally in the nature of a series of independent monographs, but there is evidence of some editorial attempt to indicate appropriate cross-references. We may impart a better idea of the nature of the book by a reference to the manner in which some of the subjects are dealt with. These we have selected at random. In the chapter on Physical Diagnosis in Pregnancy there is a useful study of the changes that occur in the position and elevation of the heart and lungs during pregnancy, with good X-ray illustrations. Tuberculosis, in an excellent chapter, is treated under the headings of menstruation and tuberculosis, marriage and tuberculosis, when pregnancy is permissible for tuberculous women, maternal changes in tuberculosis, influence of tuberculosis on pregnancy, influence of pregnancy on tuberculosis, treatment of tuberculosis during pregnancy, the offspring of tuberculous mothers. In this chapter there is a very full and useful discussion of the varying factors that go to determine the line of treatment to be adopted in this condition. In the chapter on orthopaedic diseases there is a descripton of the abnormal changes which may occur in the sacro-iliac, the pubic and the coccygeal joints during pregnancy and labour. This is an especially useful chapter on a subject which is often imperfectly understood by the obstetric practitioner. It is well illustrated.

The standard throughout the book is generally high. In a few places it tends to partake too much of the character of an ordinary textbook of medicine with little obstetric correlation. Sometimes there is evidence that the physician has strayed into obstetric spheres that are beyond his usual province, as when the author of the chapter on diseases of the kidneys states that "foetal death *in utero* has no demonstrable effect on eclampsia." So the author of the chapter on orthopaedic diseases states that the cause of separation of the symphysis pubis is descent of the foetal head and the strain of labour, and does not refer to the work of Heyman and Lundquist in Sweden and of a number of American observers who have shown conclusively that softening and separaton of the pubic bones may occur during pregnancy and that in the rare instances in which disability is found the

symptoms may actually develop before labour. It is true that in a previous excellent chapter in the book on the physiology of normal pregnancy there is a brief reference to the pubic osteopathy of pregnancy.

We can recommend this volume as one possessing considerable value to the obstetrician and the general practitioner. It succeeds in its task of presenting the reader with a well-planned, a moderately full and an up-to-date account of "obstetric medicine."

James Young.

"Practical Histology for Medical Students," by D. T. HARRIS, M.D., D.Sc., F.Inst.P. 3rd ed. 36 pp., 2 illustrations (1 coloured). London: H. K. Lewis & Co. Ltd. Price 7s. 6d.

THIS manual covers a comprehensive course of normal histology; it includes a lucid account of the necessary technical processes, and due prominence is given to the more usual routine stains. The matter is well set out, and a valuable feature is the provision of alternate blank sheets on which the student can record his own drawings and observations. The author has not lost sight of the fact that, for the medical student, the ultimate aim of this work is the understanding of human morbid processes, and whenever possible human material is used.

This book can be recommended to the medical student as an excellent guide for his histological work.

R. W. Scarff.

British Congress of Obstetrics and Gynaecology, 1936

The next Congress will be held in Belfast on April 1st, 2nd, and 3rd, 1936.

President:

Professor R. J. JOHNSTONE, M.P., F.R.C.S.

Local Scientific Secretary:

Mr. C. H. G. Macafee, 18 University Square, Belfast.

The principal discussion will be on the subject:

"Conservative treatment, by operation or otherwise, of pathological conditions of the ovaries, tubes and uterus, with special reference to functional results."

Contributions to the discussion are invited as well as papers on other obstetrical and gynaecological subjects.

The Standing Executive Committee of the Congress has decided:

(1) That all contributions and papers must be received by the Local Scientific Secretary (Mr. Macafee), together with short abstracts in a form ready for printing, by Dec. 1st, 1935.

(2) That printed copies of papers (or abstracts) shall be sent to members of Congress on request before the date of the Congress.

(3) That the opener (or openers) of a discussion and readers of papers shall not speak for more than twenty minutes in presenting their contributions.

(4) That it would greatly facilitate the work of the Secretary in the arrangement of the programme if members, other than contributors, intending to speak, would notify the Scientific Secretary as soon as the list of subjects is published and the printed contributions are available. This will carry no obligation nor will it exclude *ex tempore* speakers.

British College of Obstetricians and Gynaecologists

AT a special meeting of the Council held on Monday, 5th November 1934, the Honorary Fellowship was conferred on Emeritus Professor Archibald Donald, Alderley Edge, Cheshire, and Sir William Josiah Smyly, Dublin.

The following were admitted to the

Fellowship:

William Francis Theodore Haultain	Edinburgh

Membership:

Frederick Arthur Clift	London
David William Currie	Leeds
Morgan David Arwyn Evans	Cardiff
William Dawson Galloway	Holmfirth
Lionel George Higgins	Woking
Russell Norfolk Howard	Melbourne
Robert James Kellar	Edinburgh
John Harold Peel	London
Jack Polonsky	Cape Town and Liverpool
Arthur Lloyd Potter	Wigan
John Lelean Scholes	Melbourne
Percy Norman Leonard Seager	Dublin
Thomas Francis Todd	Preston
Charles Henry Walsh	Liverpool
Charles Alexander Whitfield	Tidworth
Bryan Williams	Birkenhead
James Smith Young	Kilmarnock

The following were admitted *in absentia* to the

Foundation Fellowship:

F. Brown Craig	Sydney
Benjamin Philip Watson	New York

Foundation Membership:

William Allan Dafoe	Toronto

Membership:

John Nicholas Chesterman	Sydney
Thomas Frederick Corkill	Wellington, N.Z.
Frieda Ruth Heighway	Sydney
Nora Proctor Sims	Baluchistan, India

Review of Current Literature.

THIS Review contains the lists of contents and abstracts of the more important articles from the following journals with which the "Journal of Obstetrics and Gynæcology of the British Empire" exchanges :—

British.—The Lancet; British Medical Journal; The Cancer Review :
Canadian.—The Canadian Medical Association Journal; Bulletin Médical de Quebec.
Australian.—Medical Journal of Australia; The Australian and New Zealand Journal of Surgery.
Indian.—The Calcutta Medical Journal.
American.—American Journal of Obstetrics and Gynecology; The Journal of the American Medical Association; Surgery, Gynecology and Obstetrics.
French.—La Gynécologie; Gynécologie et Obstétrique; Bulletin de la Société d'Obstétrique et de Gynécologie de Paris.
Belgian.—Bruxelles-Médical.
Italian.—Annali di Obstetrica e Ginecologia; Archivo di Obstetrica e Ginecologia.
German.—Archiv für Gynäkologie; Zeitschrift für Geburtshülfe und Gynäkologie; Zentralblatt für Gynäkologie; Monatsschrift für Geburtshülfe und Gynäkologie; Münchener Medizinsche Wochenschrift.
Scandinavian.—Acta Obstetrica Scandinavica.
South American.—Boletin de la Sociedad Obstetricia y Ginecologia de Buenos Ayres.
Japanese.—Japanese Journal of Obstetrics and Gynæcology.

The Review of Current Literature thus keeps the readers of the Journal in touch with current literature throughout the world. At the end of the year an Index of all the subjects contained in the articles of the above journals is printed. Arrangements are also made to include abstracts of important articles on border-line subjects, such as Physiology, Biology and Biochemistry.

LIST OF ABSTRACTORS.

London: J. BEATTIE, F.R.C.S.; A. C. BELL, F.R.C.S.; R. K. BOWES, F.R.C.S.; J. LYLE CAMERON, F.R.C.S.; R. L. DODDS, F.R.C.S.; R. C. LIGHTWOOD, M.D.; D. H. MACLEOD, F.R.C.S.; J. A. MOORE, M.B.; C. D. READ, F.R.C.S. (Edin.); F. ROQUES, F.R.C.S.; R. WINTERTON, M.D.
Huddersfield : W. E. CROWTHER, M.B.
Leeds : R. H. B. ADAMSON, M.D.
Liverpool: M. DATNOW, M.D.; P. MALPAS, F.R.C.S.
Glasgow: JANE H. FILSHILL; R. SHARMAN, M.D.; H. MACLENNAN, M.D.

The Journal of Pathology and Bacteriology.

Vol. xxxix, No. 1.

Conversion of the glycogen of the vagina to lactic acid. R. Cruickshank.
*Cultivation of the gonococcus, with reference to the oxydase-reaction and to the value of air reinforced in the carbon-dioxide content. J. W. McLeor, J. C. Coates, F. C. Happold, D. P. Priestley, and B. Wheatley

CULTIVATION OF GONOCOCCUS, WITH REFERENCE TO THE OXYDASE-REACTION AND TO THE VALUE OF AIR REINFORCED IN THE CARBON-DIOXIDE CONTENT.

It was found that the culture of many strains of gonococci is promoted by incubation in air containing eight per cent of carbon dioxide, that the recognition of gonococcal colonies in culture is greatly facilitated by the use of the direct oxydase-reaction and that the use of this reaction is a great saver of time in diagnosis.

J. Moore.

The Journal of Physiology.

Vol. lxxxii, No. 1, August 24th, 1934.

*Spectroscopic comparison of foetal and maternal blood of the rabbit and goat. F. G. Hall.
*Uterine reactivity in the mouse at various stages of the sexual cycle. J. M. Robson.

SPECTROSCOPIC COMPARISON OF MATERNAL AND FOETAL BLOOD OF THE RABBIT AND GOAT.

The oxygen dissociation curves of foetal and maternal blood are dissimilar. Spectroscopic analysis of the oxygen-dissociation of foetal and maternal haemoglobin in the rabbit and goat showed that foetal haemoglobin had a greater affinity for oxygen than maternal haemoglobin. It would seem, therefore, that this is due partly to a specific difference in their haemoglobin.

UTERINE REACTIVITY IN THE MOUSE AT VARIOUS STAGES OF THE SEXUAL CYCLE.

A series of experiments was performed, using strips of uterine muscle removed at various stages of oestrus, pregnancy, pseudo-pregnancy and parturition and the reactivity to oxytocin and spontaneous rhythmic activity determined. It was found that the rhythmic activity increased during the later stages of gestation but not further during parturition. The reactivity to oxytocin was highest just before and just after parturition. The hormonic control of the alteration in the uterine muscle is discussed.

J. Moore.

The Canadian Medical Association Journal.

Vol. xxxi, No. 1, July 1934.

*Chorea gravidarum, with the report of a case. S. Kobrinsky.
*Notes on one hundred obstetrical cases in rural practice. A. F. McKenzie.

CHOREA GRAVIDARUM, WITH THE REPORT OF A CASE.

Chorea gravidarum is a formidable complication of pregnancy. The condition, however, is extremely rare. The frequency has been stated to be one in 2,500 deliveries. At the Rotunda Hospital in a series of over 20,000 labours, no case occurred. The condition has been recognized since the seventeenth century. It is much more common in primigravidae and young patients. The general view held is that the condition, at least in a large percentage of cases, is a toxaemia. Fear has been cited as a possible cause. Against this is the observation by Boyd that chorea was not increased in London as a result of the air raids. The symptoms are not in any way different from those cases of chorea occurring without pregnancy. The movements vary from a mere restlessness to agitation so violent in character as to require boards at the sides of the bed to prevent the patient's falling out. Volition has little control in the more marked cases. Of the reported cases, 46 died. Post-mortem examination revealed cardiac lesions in 87 per cent. Cerebral lesions were absent in most; if any were present, they were of a mild character, usually affecting the corpus striatum. The condition does not seem to provoke early labour. Various authors have discussed the prognosis. The mortality for the foetus has been given as 40 per cent and for the mother 13 per cent. Barnes, in 1869, collected 56 cases with a mortality of 30 per cent.

The author reports the case of an unmarried girl of 19, whose family history and past history were negative. At the sixth month of pregnancy choreiform movements began in the hands; they gradually increased and later involved all the voluntary muscles. The movements were accompanied by dizziness and insomnia. The systolic blood-pressure was 184 to 186; a trace of albumin was found in the urine; the haemoglobin was 33 per cent. Luminal, aspirin and nembutal had a slight effect for a time. Auditory and visual hallucinations occurred.

Twenty cubic centimetres of blood from a healthy pregnant woman of a suitable group was transfused to the patient. The choreiform movements entirely ceased for several days after the blood transfusion. Premature labour was induced at the eighth month of pregnancy. Labour and the puerperium were normal. Both mother and child did well. The outstanding feature of the case is the cessation of movements after the transfusion of blood from a healthy pregnant woman of a suitable group.

A very full reference to the literature is appended.

NOTES ON ONE HUNDRED OBSTETRICAL CASES IN RURAL PRACTICE.

The author reports 100 consecutive labours among 81 mothers. Twenty-five of the mothers were primiparae, the youngest being 17, the eldest 35. The oldest multipara was 46, at the time of her fourteenth confinement, 12

of her children being alive. Sixty per cent of the cases were seen before labour. Pelvic measurements were not found of themselves to be particularly helpful; other factors had also to be considered. The lowest sacropubic measurement was 18 centimetres. Drugs were seldom given for pain in the first stage. Much good was done by assuring the patient that labour was progressing normally and that she would be spared all unnecessary pain. Chloroform was used in the second stage in all, except four, cases; the rule being to withhold the anaesthetic until the os was fully dilated. Occipito-posterior positions were responsible for a large proportion of prolonged and difficult labours. In most cases the head rotated to an anterior position spontaneously. Half a cubic centimetre of pituitrin was given in one case of non-rotation of the head in a multipara. When this failed, manual rotation was performed. There were two face presentations, one with the chin posteriorly. There was no descent of the presenting part in this case. Under chloroform a hand was inserted and pressure made upwards on the chin, while the other hand pressed downwards on the occiput, converting the presentation into an occipito-anterior. Half a cubic centimetre of pituitrin was given; spontaneous delivery soon followed. The forceps was used in 18 cases. The humerus was fractured in one case and the clavicle in another. The placenta was manually removed in one case. Delayed post-partum haemorrhage, two weeks after confinement, occurred in three cases. There were four stillbirths; in two cases the foetûs were anencephalic monsters, both these mothers were primiparae. Wasserman's test in one of the cases was negative. In one case of still-birth the child was delivered by the breech: in the fourth labour began three weeks after term and delivery by the forceps was prolonged and difficult. There were no crippled children and no deaths within the first year. The average death-rate for the province during 1932 was six per cent.

The author raises the question whether institutional obstetrics is more dangerous than confinement in the home. For Ontario during 1932 the maternal death-rate was 5.1 per 1,000 living births; the non-institutional death-rate was 2.3 per 1,000, the institutional 9.3 per 1,000—four times as great.

J. Lyle Cameron.

The American Journal of Obstetrics and Gynecology.

Vol. xxvii, No. 1.

*Radiation therapy in carcinoma of the corpus uteri. W. P. Healy.
Failures in tubal sterilization (Madlener). W. H. Rubovits and A. J. Kobak.
Fertility in the male: spermatozoa count. D. L. Belding.
Significance of menstrual disturbances in pulmonary tuberculosis. H. C. Hesseltine and W. M. Spear.
*Theca-cell tumours of the ovary. P. J. Melnick and A. E. Kanter.
Contraception: a neglected field for preventive medicine. O. J. Toland.

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*The incidence, treatment, and mortality of eclampsia. J. Burder.
Possible derivation of guanidine and histamine in the autolysis of acute placental infarcts. R. A. Bartholomew and F. Parker.
*The length of the human menstrual cycle. C. F. Fluhmann.
Sickle-cell anaemia in pregnancy. A. F. Lash.
Placental necrosis. A. B. Clements.
Modification in the technique of the Bell-Beuttner operation. F. H. Falls.
Blood-chemistry studies of normal newborn infants. A. Holman and A. Mathieu.
Tumours of the urethra. C. H. Phillips and M. D. Douglass.
The treatment of recent puerperal inversion of the uterus. D. N. Barrows.
*Nembutal and scopolamine analgesia in labour. L. Averett.
Pathogenicity of the monilia vaginitis and oral thrush. H. C. Hesseltine and E. D. Plass.
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Two cases of congenital cardiac disease. A. L. Dippel.
Society transactions.
Department of Maternal Welfare: maternal mortality.
Collective Review: Syphilis complicating pregnancy.

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Polycystic ovaries in the newborn and early infancy and their relation to the structure of the endometrium. Mary Spivack.
Tuberculosis of the uterus and Fallopian tubes with a report of two cases treated with X-rays. E. M. Jameson.
*Pathology of intracranial haemorrhage in the newborn child. Evon Haam.
*Birth injury of the occipital bone with a report of 32 cases. F. A. Hemsath.
*Bacteriological findings in the uterus during labour and early in the puerperium. R. G. Douglas and H. S. Rhees.
Surgical consideration of appendicitis in pregnancy. Urban Maes.
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Comparison of the Aschheim-Zondek test and the Friedman test in normal and abnormal pregnancy. H. C. Mack and G. H. Agnew.
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*Calcium in the treatment of dysmenorrhoea. R. E. Boynton and E. C. Hartley.
Malignant neoplasms of the ovary. A. W. Jacobs.
Missed abortion with superimposed pregnancy. N. K. Forster.
Induction of labour by rupture of the membranes. Leo. Wilson.
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A case of bilateral ovarian tumours of the Breuner type. J. M. Maury and H. C. Schmeisser.
A case of double vagina, cervix, and uterus. L. H. Biskind.
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The challenge of the falling birth-rate. J. C. Litzenberg.
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*Histopathology of epithelial hyperplasia and neoplasia of the cervix uteri. Henry Schuritz, F. A. McJunkin, and M. A. Macaluzo.
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*The length of labour. III. L. A. Calkins.
*Complications resulting from pelvic irradiation for cancer of the cervix. P. Findley.
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Amenorrhoea and oligomenorrhoea associated with low basal metabolic rates. R. D. Mussey and S. F. Haines.
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Prenatal care in private and clinical practice. G. D. Rouptow.
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A method for biopsy and for facilitating insertion of radium in carcinoma of the cervix. H. Stranos.
Atelectasis of the newborn with recovery following intratracheal insufflation. D. A. Bristoll.
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Department of Maternal Welfare.
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Radiation Therapy in Carcinoma of the Corpus Uteri.

Although the author acknowledges that hysterectomy is regarded as the treatment of choice for carcinoma of the uterine body, he maintains that many cases are not suited for operation because of senile degenerative changes in vital organs, and that recurrences have developed within two or three years in many cases so treated. Consequently he advises treatment with radium, especially in elderly women. He groups his cases under Ewing's well-known classification, (*a*) papillary adenoma malignum, (*b*) adenoma malignum, (*c*) adenocarcinoma, (*d*) solid cellular or diffuse carcinoma; and compares the results of radiation, radiation with operation, and operation alone in each group. His conclusions are that radiation in full doses, either alone or some weeks before hysterectomy, gives the best chance of freedom from recurrence in all types, and that patients so treated have lived longer than those for whom hysterectomy alone or hysterectomy followed by radiation has been the treatment. In a description of his technique the author stresses the importance of placing the radium needles in the uterus end-to-end so as to irradiate the whole of the uterine cavity. He advocates a total dosage of 3,000–4,000 milligramme-hours, so divided among the needles that the application does not last for longer than 30 hours. In some cases a high voltage X-ray cycle is started after two or three days; or, if hysterectomy is contemplated, the operation after about six weeks.

Theca-cell Tumours of the Ovary.

Mention is made of Robert Meyer's classification of certain rare tumours of the ovary which alter the sexual characteristics of the individual. The author adds another type, previously reported only by Löffler and Priesal in 1932, which arises from the theca interna, and, like the granulosa-cell tumour, produces glandular hyperplasia of the endometrium associated with post-menopausal bleeding or, in young women, amenorrhoea. He believes that the exertion of a distinct hormonal effect by these tumours strengthens the evidence that the theca cells take part in the production of oestrin.

Two cases are described by him. In both the chief complaint was bleeding after the menopause and the finding of a yellowish ovarian tumour about the size of an orange. A full description of the histological appearances is given, the chief points being the presence of fusiform cells with delicate intercellular connective-tissue fibrils and the finding of cholesterol, or its ester, in the yellow lipoid droplets.

In discussing the similarity of the clinical picture of these tumours and the granulosa-cell tumour, the author suggests that the hormone is not secreted by the tumour of the latter type but by the theca interna, stimulated into increased activity by the abnormal granulosa cells. He emphasizes the fact that the tumour under discussion must arise from the theca interna because of its connective tissue-like structure and the presence of cholesterol. Granulosa-cell tumours are reported to contain phospholipins.

THE INCIDENCE, TREATMENT AND MORTALITY OF ECLAMPSIA.

After studying the results of cases treated for eclampsia from July 1926, to October 1932, Binder comes to the conclusion that the incidence of eclampsia is definitely reduced by ante-natal care and that the conservative treatment gives better results than any of the radical measures used for emptying the uterus. He condemns Caesarean section unless there is a definite pelvic indication, and advocates spinal anaesthesia in all cases in which the child is delivered by the forceps.

THE LENGTH OF THE HUMAN MENSTRUAL CYCLE.

Fluhmann shows there is a wide variation of the menstrual cycle in normal healthy women. He also says that it is not possible to group the subjects into 28-day types, 30-day types, 21-day types, etc., because the length of successive menstrual cycles varies in so many of them. The menstrual cycle was regular in only about one-third of the cases in his series.

NEMBUTAL AND SCOPOLAMINE ANALGESIA IN LABOUR.

The author considers nembutal the safest of the barbiturates now in vogue as analgesics in labour. This drug is excreted more rapidly than pernocton and sodium amytal, and is, therefore, much less toxic. After trying various doses he came to the conclusion that the best results were obtained by the oral administration of six grains of nembutal followed by a hundredth of a grain of scopolamine when labour was definitely established. He also found that nembutal gave rise to less restlessness than pernocton and that its sedative action was prolonged by a small dose of scopolamine.

PATHOLOGY OF INTRACRANIAL HAEMORRHAGE IN THE NEWBORN CHILD.

An account is given of the post-mortem investigation of 317 full-time and premature infants. In 50 cases, or 16 per cent, an intracranial haemorrhage was found. In 54 per cent of these cases prematurity was a factor; in 48 per cent there was a history of trauma during birth. Of the premature infants 16 had been exposed to such trauma. In 14 cases, or 28 per cent, the labour had been normal, and the examination of the body revealed no disease which might account for the intracranial haemorrhage. The post-mortem examination was done with the greatest care, a special technique being employed as the routine in each case. Only macroscopic collections of blood in the cranium were included, in each case in which such a collection was found a microscopic examination of other organs was made, to prove the presence or absence of congenital syphilis or haemorrhagic disease of the newborn.

In discussing the pathology the author suggests a slight variation in the nomenclature of the usual classification of intracranial haemorrhage to express the localization more definitely. In 34 cases large collections of blood were found, with tearing of the tentorium or injury to the sagittal sinus, and were concluded to be the cause of death; in 12 small subdural haemorrhages without apparent vascular injury were found; and in four intracerebral haemorrhage was present. The author discusses the cause

of injury to the tentorium and strongly favours the mechanical aetiology rather than the theory of asphyxia. He stresses the fact that one of the functions of the dura is to hold the loose skeleton of the infantile skull together and to prevent exaggerated disfigurations. In premature infants the dura is not so strong as in the full-time child and is thus more likely to rupture; hence prematurity is a very important factor.

Birth Injury of the Occipital Bone.

Hemsath discovered 32 examples of injury to the occipital bone in 132 successive autopsies at the New York Lying-in Hospital. The site of the lesion was the synchondrosis between the *pars squama* and the *pars lateralis* of the occiptal bone. It was in the form of a separation rather than a fracture and caused varying degrees of stripping of the dura mater and pericranium. This tended to cause compression of the cerebellum and haemorrhage round the medulla.

The author explains that the mechanism of the injury is due to impingement of the sub-occipital region against the symphysis, especially in the delivery of the aftercoming head, there being 20 autopsies, or 42 per cent, in cases delivered by the breech; and in cases delivered by the forceps to traction in the wrong direction, there being 10 autopsies, or 33 per cent, in cases delivered by the forceps. However, two cases occurred in spontaneous deliveries, or 2.3 per cent of autopsies of normal cases. In each of these there was difficulty in delivering the shoulders, and the author suggests that traction was exerted by the hands of the obstetrician being placed on the occiput and face instead of on the sides of the head.

A similar type of injury was first described by Schroeder over 60 years ago; no figures were given, but he implied that he had seen many cases. Since then only three cases have been reported.

Bacteriological Findings in the Uterus During Labour and Early in the Puerperium.

The authors report the investigation of 171 consecutive cases. These were divided into four groups, (*a*) 37 patients nearly afebrile, (*b*) 47 patients who had spontaneous deliveries with no repair but with a temperature rising to 38°C. on at least one occasion, (*c*) 42 patients who had spontaneous deliveries and repair of the perineum, vagina, or cervix, and with febrile puerperia, (*d*) 45 patients who had operative deliveries with or without repair and who also had febrile puerperia. Fourteen patients of the entire series had a negative uterine culture. Of the remainder anaerobic streptococci were found most frequently; the incidence being 65 per cent in the first and fourth groups and slightly higher in the other two groups. Anaerobic gas-forming bacilli were found following operative deliveries in six instances, an incidence of 3.5 per cent. The colon bacillus was found in 8.7 per cent of the cases, and three times more frequently after operative than after spontaneous delivery. Staphylococcus aureus was found only once, and in no case was the aerobic haemolytic streptococcus found.

The urine was cultured in 121 cases of the series. Organisms were grown in 71 cases; in 10 cases, or 13 per cent, of spontaneous delivery, and 12 cases, or 26.5 per cent, of operative delivery. The organisms re-

covered from the urine were the same as those found in the lochia. Organisms were grown from the blood in 17.11 per cent of the cases; in 66.6 per cent of these the patients had been operatively delivered. All patients on whom Caesarean section was performed and who showed positive uterine cultures at the time of operation, later developed febrile puerperia.

Calcium in the Treatment of Dysmenorrhoea.

Forty-nine undergraduates suffering from essential dysmenorrhoea were treated. The authors found that 33 were definitely benefited or completely relieved, while 16 were not improved. Treatment was divided into the following ways: (*a*) Calcium gluconate, 16 grains daily for 10 to 14 days before the onset of the period and for the first two days of the period. Nine cases were improved; five did not benefit. (*b*) Calcium gluconate with the addition of viosterol, given in 30-drop doses daily for the same length of time. Sixteen cases benefited, while nine did not benefit. (*c*) Alkaline mixture; magnesium carbonate and sodium bicarbonate, 30 grains of each three times a day for 10 days before the onset of the period. Five cases were cured, while two were not relieved. (*d*) Alkaline mixture with calcium gluconate. All three cases benefited.

The authors found that the patients with essential dysmenorrhoea, who also gave a history of bruising easily, responded more favourably to calcium therapy than those who did not give this history.

Histopathology of Epithelial Hyperplasia and Neoplasia of the Cervix Uteri.

The authors investigated, by serial sections, a number of amputated cervices in order to study the hyperplastic changes in the squamous epithelium in cases of chronic cervicitis. In 15 out of 72 cases three sets of changes were found, which are present in advanced cervical cancer, but are also seen in the absence of malignancy. In the cytoplasmic and nuclear changes they report lessened keratinization, hyperchromatism with some mitosis, irregularity in size and shape of the nuclei, and abrupt transition between the new and old squamous epithelium. Stress is made of the fact that in the first stage of cervical neoplasia typical mitoses are infrequent. In epithelial heterotopia they found epidermoidization of the cervical glands relatively common.

The stratified squamous epithelium penetrates beneath the columnar cells, the latter disappear, and finally the gland becomes a solid plug of squamous epithelium. In many cases abnormal depth of penetration of squamous epithelium was found with attempted formation of epithelial pearls even in the absence of malignant changes. The third change, that of stroma reaction, could only be interpreted as being due to blastomatoid changes in the epithelium when no inflammatory processes were present on the surface or in the glands. Of the whole series six cervices showed all three changes, and the authors came to the conclusion that they were potentially malignant.

THE LENGTH OF LABOUR. III.

In a very interesting clinical study of the first stage of labour Calkins enumerates the various factors which lead to a shortening of the time of this stage. As the first stage is entirely due to the effacement and dilatation of the cervix he begins with that structure. He recognizes that the length of the canal, the thickness of the wall, and the amount of dilatation present previous to the initiation of labour are all important but confines his study to a fourth factor—that of its consistence. In a series of cases he groups the consistence of the cervix as *mushy softness, softer than usual, normal softness,* or *firm*. The greatest number came into the second and third groups and in both primiparae and multiparae the length of the first stage was much longer in the third and fourth groups than in the first and second. In his study of the pains of labour he takes the following factors as being indications of the action of the uterine muscle.

Frequency. He found that when the pains recurred at intervals of six, 10, or more minutes the duration of the first stage was much more prolonged than when they recurred at intervals of less than three minutes or between three and five minutes.

Duration. Whereas a longer labour pain seemed to make for more rapid progress in multiparae, the difference was not great; in primiparae the length of the pain did not seem to make any difference.

Intensity. This was gauged by noting the amount of indentation of the uterus during a contraction by pressure with one finger on a part where the infant could not be felt. The cases were grouped under the headings of *very weak, weak,* or *moderate to strong pains*. It was found that the strength of the pain had a marked influence on the length of the first stage.

He recognizes that each of these characteristics might change as labour progresses, but from the study of this group of cases he found that the character of the initial pains was carried through the whole of the first stage in a large proportion of cases. Thus he is assured that these investigations should play an important part in the clinical study of labour.

COMPLICATIONS RESULTING FROM PELVIC IRRADIATION.

The author describes the various complications associated with or following the treatment of cervical cancer with radium. Most of these complications were due to the non-recognition of some septic condition in the pelvis, such as pyometra, salpingitis, cellulitis, or cystitis; to imperfect technique and screenage of radium in the vagina giving rise to irritation of the bladder and rectum or even to the formation of fistulae between these organs and the vagina, and to the unavoidable sequelae of pyometra, hydronephrosis and pyonephrosis resulting from the contraction of scar-tissue in the cervix or parametrium. He deplores the ease with which general practitioners can hire radium and the *sang froid* with which they apply this radium without the adequate experience necessary for the diagnosis or treatment of this important condition.

In the discussion, which followed the reading of this report, other surgeons reported rarer complications, and expressed the opinion that the

absence of special experience in the use of radium tended to result in inadequate treatment. This was more to be deplored than the formation of fistulae after treatment.

B. Jeaffreson.

Surgery, Gynaecology and Obstetrics.

Vol. 59, No. 2, August 1934.

*A study of various renal function tests in relation to the toxaemias of pregnancy. J. F. Cadden and C. M. McLane.
*Friedman's test in hydatid mole. M. Y. Dabney and E. B. Dabney.
*The intra-uterine diagnosis of monstrosities. G. W. Gustafson.
*An explanation of prolonged labour in cases of occipito-posterior position. C. Burger.

A Study of Various Renal Function Tests in Relation to the Toxaemias of Pregnancy.

The authors have studied the phenolsulphonaphthalein creatine excretion and urea clearance tests in 23 cases of normal pregnancy, and in 343 women suffering from one or other type of toxaemia of pregnancy. The values obtained from these tests are set out in tables.

Of the three tests, the urea clearance was the only one sufficiently sensitive to differentiate chronic nephritis from the other toxaemias of pregnancy.

The lower limit of normal for the urea clearance test is in the neighbourhood of 70 per cent normal, and the average urea clearance value for nephritis is 75 and 68 per cent normal for antepartum and postpartum respectively. Fifty per cent of all the nephritic patients showed values below 70 per cent normal. There is not any apparent relation between blood-pressure and renal function as measured by the urea clearance test, nor is there renal impairment, according to this test, in the low reserve kidney group.

The authors recommend the urea clearance test as the most sensitive method so far devised to recognize early or mild nephritis. It is essential, however, that the tests be repeated at two-hourly intervals.

Friedman's Test in Hydatid Mole.

In this paper the authors discuss the diagnosis of mole by Friedman's technique and report a case. In the Friedman test from 10 to 30 cubic centimetres of a morning specimen of urine, in divided doses, are injected into a mature female rabbit.

A case is reported here of a woman 47 years old, who was admitted to the Hillman Hospital on June 13th, 1933, complaining of vomiting, uterine bleeding and enlargement of the abdomen. Her oldest child was 27 and her youngest seven. She had had a miscarriage nine years previously. She had always suffered from dysmennorrhoea. More than a year before

she had had menorrhagia, hot flushes and an enlarged abdomen. Her periods at that time lasted from 10 to 14 days. For five months before her present illness they were regular and normal at intervals of 27 to 30 days and lasted three to five days. She had a slight attack of influenza before her period in May. On May 16th she began vomiting incessantly and experienced a daily vaginal loss. Nervousness and hot flushes returned. She was in bed three weeks, had nocturnal frequency of micturition, and for the preceding two days, vomited blood. Physical examination showed many missing and carious teeth, marked endocervicitis and the uterus enlarged to the size of a six months' pregnancy. Anaemia was present; the analysis of the urine, Wassermann's and Kahn's tests were negative.

X-ray examination in June and July showed a soft tumour in the pelvis, but an outline of the foetus could not be seen. The general condition of the patient improved after admission to hospital and she was transferred from the obstetric ward to the gynaecological ward. It was thought that the case might be one of the menopause complicated by a fibroid; a dead foetus was also considered and hydatidiform mole suspected.

Friedman's tests were employed as follows: Mature nulliparous rabbits were used; 22, two, 0.5 and 0.06 cubic centimetres of a morning specimen of urine were injected; a positive result was obtained in each case. On July 27th the patient complained of pains similar to labour pains, and the uterus was emptied. The specimen removed weighed 912 grammes and was diagnosed in the laboratory as a hydatidiform mole. The patient made a good and uneventful recovery. The authors note that, although 24-hour specimens of urine were not employed, Friedman's tests of this patient came within the limit mentioned by Mazer for a positive diagnosis of mole, since a positive reaction followed the injection of 0.06 cubic centimetres of urine.

The Intra-uterine Diagnosis of Monstrosities.

Only two means of absolute diagnosis of intra-uterine monstrosities are available. The first is by the employment of roentgenography and the second by direct palpation vaginally.

Five cases of monstrosities *in utero*, diagnosed before delivery, are reported by the authors. The first four were diagnosed by the X-rays and the last by palpation. The first was examined by the X-rays because of the presence of acute hydramnios, the second was discovered because the authors were attempting to find evidence of foetal death by X-rays; the third was submitted to examinaion by X-rays because of an abnormally large foetal head, while the fourth was found because frequent abdominal examinations revealed the absence of a demonstrable head in the pelvis or fundus. The fifth case which was diagnosed by palpation, presented an unusual condition. Palpation revealed smooth tissue inside the cervix which did not feel like placental tissue. The cervix was dilated, and after slight traction the tissue came down into the vagina—on inspection it looked like foetal bowel. This patient spontaneously delivered a macerated foetus.

The authors feel that the intra-uterine diagnosis of foetal monstrosities is to be highly desired, and when possible every candidate for Caesarean section should be examined by the X-rays, especially in cases of placenta praevia.

AN EXPLANATION OF PROLONGED LABOUR IN CASES OF OCCIPITO-POSTERIOR POSITION.

The author states that in his experience it is mainly the first stage which is lengthened in cases of occipito-posterior position. Prolongation of the second stage is not significant in itself since it results either from exhaustion of the uterine musculature produced by an extended first stage, or from the non-engagement, or tardy descent of the occiput into the pelvic cavity. In the author's series of cases these complications occurred in 20 to 25 per cent of labours in which the occiput was posterior. The available literature gives no explanation of the lack of proper descent of the head into the pelvic cavity in certain cases, and the author has, therefore, sought an explanation of this, since it cannot be attributed entirely either to primary inertia or to ineffective uterine contractions.

The anterior pelvic wall, consisting of the ossa puborum, is much lower than the posterior wall formed by the hollow of the sacrum. As the head traverses the pelvis in the direction of the so-called pelvic axis, all points of the presenting part do not advance an equal distance. The part nearer the public arch reaches the outlet sooner than that approaching the sacrum. In occipto-anterior positions the small fontanelle is in the anterior part of the pelvis, and after descending only a few centimetres, reaches a ponit deep in the pelvic inlet. But if the small fontanelle is in the posterior section of the pelvis, the head will not have engaged in the inlet after traversing the same distance. Obviously, if the small fontanelle is in the posterior quadrant of the pelvis the course of labour will be more difficult. The difficulty will be relatively insignificant if uterine action is vigorous or if the head is small in comparison with the pelvic diameters.

C. D. Read.

Journal of the American Medical Association.

Vol. cii, No. 25, June 23rd, 1934.

*What is a normal pelvis? H. Thoms.
*Gonococcal peritonitis. T. F. Hugh.

Vol. ciii, No. 1, July 7th, 1934.

Involutional melanchola. A. A. Werner, G. A. Johns, E. F. Hoctor, C. C. Ault, L. H. Kohler, and M. W. Weis.
*Therapeutic value and effects of amniotin in gonorrhoeal vaginitis in children. J. Huberman and H. H. Israeloff.

Vol. ciii, No. 4, July 28th, 1934.

Menstrual oedema: preliminary report. J. S. Sweeney.

Vol. ciii, No. 5, August 4th, 1934.

Obstetrics versus midwifery. Chairman's address. J. B. De Lee.

Vol. ciii, No. 6, August 11th, 1934.

*Present endocrine diagnosis and therapy: a critical analysis based on hormone studies in the female. R. T. Frank, M. A. Goldberger and F. Spielman.

*Fibroma of vagina resembling cystocoele. Hamlin Mattson.
Standards of prenatal care. Current Comment.
Vol. ciii, No. 8, August 25th, 1934.
*Conservative treatment of late toxaemias of pregnancy, with special reference to the intravenous use of magnesium sulphate. L. G. McNeile.
Ovarian cyst: report of an unusual case. W. K. Lloyd, A. M. Showalter, and J. G. Davis.

What is a Normal Pelvis?

The author points out that external pelvimetry is not an accurate guide to the measurements of the pelvic inlet as judged by accurate X-ray photographs of the pelvis. The fact that aboriginal races have easy labours is well established, and as these women have in general a rounded pelvic inlet it is at once clear that the round foetal head fits the pelvis to far greater mechanical advantage than obtains in the oval pelvis of their civilized sisters. The round, or male, type and the anthropoid types of pelvis are often associated with primary and secondary occipito-posterior positions. In a recent study the author has investigated by radiological methods 50 consecutive primiparae of whom 23 possess either the round or elongated pelvis already referred to. The suggestion is made that the predominant type of pelvis which was formerly seen in clinics may have actually changed in character within a generation, for at the present time it would appear, from a purely obstetrical point of view, that the adult female pelvis is preferably round instead of oval.

Acute Gonococcal Peritonitis of the Right Upper Quadrant in Women.

Three cases are described of what is believed to be acute gonococcal peritonitis of the right upper quadrant in young women, the clinical and pathological pictures are sufficiently distinct and uniform to justify the belief that the diagnosis may sometimes be made without great difficulty. These cases, which represent the acute stage, help to complete the picture of the condition the end stage of which has been described by Curtis as "violin string" adhesions between the anterior surface of the liver and the anterior abdominal wall occurring in women with present gonococcal salpingitis or a previous history of that condition.

Therapeutic Value and Effects of Amniotin in Gonorrhoeal Vaginitis in Children.

The authors have confirmed the results obtained by Lewis when using injections of oestrin in young children suffering from gonorrhoeal vaginitis in order to produce proliferation of the vaginal mucous membrane which clears up the discharge and eradicates the gonococci. Six children were selected for treatment and the disease was conclusively proved to be present. One hundred rat units of amniotin were administered hypodermically three times a week. In three cases which suffered from a somewhat chronic infection the disease was cured after a total average injection of 2,100 units of

amniotin. The second group which consisted of acute cases required 27 injections amounting to 2,700 rat units. The method of treatment described is safe and definite involution of the vaginal structures occurs after treatment.

PRESENT ENDOCRINE DIAGNOSIS AND THERAPY: A CRITICAL ANALYSIS BASED ON HORMONE STUDIES IN THE FEMALE.

This is a most instructive article which is impossible to abstract with accuracy. The authors state that it has been their object since 1925 to place the study of functional endocrine disturbances of the female sexual organs on a more solid foundation and to devise methods that will permit the evaluation of conditions comparable to metabolic determinations. The material upon which this article is based consists of 1,773 oestrogenic-substance tests on blood, 1,269 urinary tests for oestrogenic substance, 661 anterior pituitary tests on the blood, 78 anterior pituitary like tests on the urine, 1,843 tissues, cystic fluids, bile, cerebro-spinal fluid and the like tested for oestrogenic substance, and 916 gestational tests.

FIBROMA OF VAGINA RESEMBLING CYSTOCOELE.

A case of this somewhat rare tumour is described in detail with a microphotograph of the growth after removal. The fibroma was soft due to degenerative changes, situated on the anterior vaginal wall, and closely simulated a cystocoele in a nullipara of 31 years. Removal was uncomplicated and convalescence uneventful.

CONSERVATIVE TREATMENT OF LATE TOXAEMIAS OF PREGNANCY.

In 799 cases of late toxaemias of pregnancy, 259 were of the eclamptic type. There was a definite decrease in the mortality in eclamptic patients treated by the following conservatiive method. Absolute rest, a milk diet with maintenance of a fluid balance. The bowels are kept open with magnesium sulphate, one ounce every six hours, until the stools are fluid and then half an ounce is given daily. Twenty cubic centimetres of a solution of magnesium sulphate, in the strength of 10 per cent, is administered intravenously when the systolic blood-pressure is 150 or higher, and is repeated when indicated by a rising blood-pressure or other evidences of increasing toxaemia. Dextrose, 300 cubic centimetres of a 25 per cent solution, is given intravenously from one to four times daily and is particularly important in patients with a decreased urinary output, with or without a low carbon-dioxide combining-power of the blood. Patients who are very restless are given chloral hydrate, 20 grains, and sodium bromide, 60 grains, per rectum. Premature labour is induced only if the patients do not improve, or if the toxaemia becomes more severe, after a reasonable time.

The patient with convulsions is treated as follows. Twenty cubic centimetres of a solution of magnesium sulphate, in the strength of 10 per cent, is administered intravenously as soon as possible after the first convulsion and is repeated every hour until the fits are under control. The subsequent dosage is based on recurrence of fits, elevation of the blood-pressure and other signs. Inhalations of pure oxygen are administered to the patient after each fit and are continued until respiration is normal. When the

patient is in labour, nitrous oxide or ethylene is given to produce analgesia during the contractions, if the restlessness cannot be adequately controlled by the rectal administration of chloral hydrate and sodium bromide. The administration of dextrose is continued. Delivery with the forceps is not a routine measure, unless there is delay in the second stage of labour. Caesarean section is employed only in fulminating cases or if there is some true obstetrical indication.

John Beattie.

Gynécologie et Obstétrique.

Vol. xxix, No. 3, May 1934.

The formation of an artificial vagina by the aid of full-time foetal membranes. Brindeau.

Digital evacuation of the uterus combined with the intravenous injection of pituitrin as a substitute for vaginal packing in the treatment of post-partum haemorrhage. Bohler and Reiles.

The use of mechanical traction in obstetrics. Houssay.

*The treatment of irreparable vesical fistulae by exclusion of the lower urinary tract. Roca.

Observations on the Wolffian body and the Müllerian ducts. Quadras-Bordes, Pla Majo.

The value of artificial sunlight in hastening the healing of perineal repairs. Gillerson, Hatzkelevitch, and Rabinovitch.

A personal modification of Crédé's manoeuvre. Karnicki.

*The vitamin deficiencies of pregnancy and lactation. Vignes and Olivier.

Vol. xxx, No. 1, July 1934.

The pathology of oedema of the cervix during labour. Cathala, Seydel.

*A study of 24 years' experience with the lower segment Caesarean operation. Ginglinger and Tassovatz.

The aetiology and pathology of pelvic varicocoele and fibro-cystic ovarian changes. Castáno.

A case of pernicious anaemia of pregnancy. Baron.

THE TREATMENT OF IRREPARABLE VESICAL FISTULAE BY EXCLUSION OF THE LOWER URINARY TRACT.

In the presence of an irreparable vesical fistula,. in which there is an extensive loss of tissue including the trigone and sphincter, four courses lie open to the surgeon. Further treatment may be abandoned and the patient left alone in a most wretched condition. The use of a urinal may be recommended. To most of these appliances there is the objection that the vulva is left bathed in urine. If an appliance is to be used the author favours a type with a spherical receptacle fitting closely into the vagina and obturating the fistula. Unforunately, the tendency of the bladder to prolapse through

the fistulous opening may render the use of any such appliance impossible owing to the extreme sensitivity of the exposed mucosa.

The older operative procedures entailed the utilization of either the vagina or rectum as a reservoir for the urine, involving an operative closure of the vagina, or else implantation of the ureters into the bowel. These operations are rightly condemned by the author as unsound. Even if technically successful, very little relief may be afforded to the patient, since the urine is only diverted and little or no continence is afforded.

The method advocated in the present article is the establishment of a permanent suprapubic cystosomy, the complete exclusion of the lower half of the bladder and urethra and the re-education of the upper half of the bladder to retain urine.

The space of Retzius is opened by a median incision and the bladder is very freely mobilized down to the fistula. The union between the bladder and vagina is then completely divided at the level of the fistula, after which the vagina is closed from above, leaving a small opening in front for drainage. The next step is to expose and mobilize the ureters lest they be included in the suture-line. The mobilized half of the bladder is then sutured so as to bring its lower wall upwards and forwards to form the anterior wall of the reconstituted organ, and the former anterior wall upwards to form the apex, through which the cystostomy opening is to be made. The margins of the opening are sewn to the skin three centimetres above the pubis. A tube is introduced into the bladder through the opening and the space of Retzius drained for 48 hours. A fortnight later, under local anaesthesia, the funnel of vesical mucosa passing through the abdominal wall is resected and the pyramidalis muscles sutured round the opening.

A tube is left intermittently in the cystostomy opening until the bladder regains its tolerance. A capacity of at least 250 cubic centimetres was obtained in the two successful cases described in the article, and micturition was voluntary.

As the essential object of the operation is to provide a continent receptacle for the urine it is not suitable for old-standing fistulae with complete atrophy of the bladder. Unforunately this reservation will preclude the use of the technique in most of those cases ordinarily encountered in which such a radical procedure might be considered.

The Vitamin Deficiencies of Pregnancy and Lactation.

This article is a valuable general review of this subject together with a bibliography. The several vitamins are considered separately. The article is too compressed to permit of satisfactory abstraction.

A Study of a 24 Years' Experience with the Lower Segment Caesarean Operation.

This lengthy paper is devoted to a discussion of the growth of the present views of the Strasbourg clinic on the subject of obstructed labour. The opinions expressed conform in the main to those generally accepted. Three hundred and forty-six lower segment operations were performed during the 24 years under review up to 1924. Among the list of indications for

the performance of the operation it is interesting to note 18 cases in which the operation was performed for inertia alone. The authors emphasize that in many cases of obstructed labour a lower segment operation is safer, despite its risks of infection, than a difficult traumatizing vaginal operation.

The mortality was 4.33 per cent, one-third of the deaths being due to peritonitis. The foetal mortality was 6.3 per cent. This high figure is ascribed to the fact that the authors have used the operaton to an increasing extent as a maternal life-saving measure without regard to the child's condition. Of 147 patients who could be traced it was found that 55 per cent subsequently became pregnant.

The authors consider that despite the increase in the margin of safety afforded by the method in the presence of infection, there still remains a small percentage of grossly infected cases in which the operation should be completed by hysterectomy.

P. Malpas.

Bulletin de la Société d'Obstetrique et de Gynécologie de Paris, Etc.

No. 4, April 1934.

SOCIETE D'OBSTETRIQUE ET DE GYNECOLOGIE DE LYON.

A case of acute arthritis after a septic abortion. Trillat and Boulez.

*The co-existence of a negative Wassermann reaction and the presence of spirochaetes in the foetal liver. Pigeoud and Brochier.

A case of encephalocoele. Voron and Banssillon.

Two cases of foetal hydrocephalus. Rhenter, Dardaillon and Lavabre.

Repeated bleeding after coitus in a patient aged 65. Cotte and Rivollier.

Perforation of the uterus during a criminal abortion. Dubois.

*Rupture of Caesarean scars in the lower uterine segment. Trillat.

*A case of vulval carcinoma in pregnancy. Trillat and Contamin.

REUNION OBSTETRICALE ET GYNECOLOGIQUE DE MONTPELLIER

A human embryo measuring 11 millimetres. Roume.

The emergency evacuation of the uterus. Madon.

Toxic vomiting in the last three months of pregnancy. Delmas, Battle and Zakhajm.

Congenital amputations and grooves due to amniotic bands. De Carrera and Battle.

A retro-chorionic haematoma with a placenta praevia. Delmas, Battle and Zakhajm.

Adnexal tuberculosis associated with proliferating tumours of the ovaries. Lapeyre and Estor.

REUNION OBSTETRICALE ET GYNECOLOGIQUE DE NANCY.

Intraperitoneal haemorrhages of ovarian origin. Hamant and Grimault.
The use of high frequency for the pruritus of pregnancy. Hartemann.
*Two cases of diffuse neurofibromatosis with pregnancy; dystocia from a pelvic neuroma. Fruhinsholz, Louyot and Richon.
The treatment of sterility with intra-uterine pessaries. Hamant.
Cervical-vaginal adhesions after labour. Vermelin.

SOCIETE D'OBSTETRIQUE ET DE GYNECOLOGIE DE STRASBOURG

Twenty-four years of experience with lower segment Caesarean section. Ginglinger.
*Three cases of sarcoma of the uterus. Meyer.
Multiple malformations in a foetus. Oberlinckels and Wilwers.
A depressed fracture of the parietal bone in a newborn child; recovery after trephining. Mercenier.
Severe haemorrhage due to an injury to the urethra during labour. Wehrung.

No. 5, May 1934.

SOCIETE D'OBSTETRIQUE ET DE GYNECOLOGIE DE PARIS.

*Twenty-six cases of anaesthesia with sodium evipan in labour. Lorier and Mayer.
Dystocia due to a pelvic kidney. Lorier and Mayer.
A discussion of Joly's paper on the radiological treatment of malignant ovarian tumours. Moulonguet.

SOCIETE D' OBSTETRIQUE ET DE GYNECOLOGIE DE MARSEILLE.

Pruritus vulvae cured by resection of the persacral nerve. Cottalorda and Gavaudan.
A two-faced monster. Guérin-Valmale and Plasse.
Painful relaxation of the symphysis. Gavaudan.
*A note on the technique of the Friedmann reaction. Verdeuil.

REUNION OBSTETRICALE ET GYNAECOLOGIQUE DE NANCY.

Prolonged retention of a foetus at the fifth month of gestation. Charles.
The treatment of obstetrical fractures of the femur. Froelich.
A case of latent rupture of the uterus. Louyot, Bodart and Lacourt.
A paravaginal dermoid cyst. Hamant, Chalnot and Lévy.
A case of cornual haematometra. Hamant, Rothan and Vichard.
The Aschheim-Zondek test in a case of molar pregnancy. Hartemann.

SOCIETE D'OBSTETRIQUE ET DE GYNECOLOGIE DE STRASBOURG

Cases of vesico-vaginal fistula. Reeb.
Intraperitoneal haemorrhage of luteal origin. Fournier.
*Pregnancy after the intra-uterine application of radium. Burger.

No. 7, July 1934.

SOCIETE D'OBSTETRIQUE ET DE GYNECOLOGIE DE PARIS.

*The dissociation of follicular fluid and folliculin. Moricard.
A late complication of ventral fixation of the uterus. de Groot.
The Mongolian blue mark in newborn negro children. Metzger and Clarin.

REUNION OBSTETRICALE ET GYNECOLOGIQUE DE NANCY.

Two cases of severe postpartum anaemia. Michon and Louyot.
Pneumococcal peritonitis in the course of pneumonia in a pregnant woman. Hartemann and Lacour.
A vaginal cyst in a newborn child. Mutel.
Tubal abortion. Vermelin and Guillemin.
Ill-advised Caesarean section. Vermelin.
*The advantages of using a thin layer of injected fluid in the radiological examination of the uterus. Hamant, Chalnot and Thomas.
Hydramnios in a fibroid uterus. Vermelin, Chalnot and Louyot.

SOCIETE D'OBSTETRIQUE ET DE GYNECOLOGIE DE TOULOUSE.

*The treatment of uterine fibroids. Ducuing.
*The results of the radiological treatment of fibroids. Ducuing, Bertrang-Pibrac and Guilhem.

The Co-existence of a Negative Wassermann Reaction with the Presence of Spirochaetes in the Foetal Liver.

Four cases in which the maternal Wassermann reaction was negative, despite the fact that spirochaetes were found in abundance in the foetal livers, are recorded.

Rupture of Lower Segment Caesarean Scars.

Trillat gives an incidence of subsequent rupture of the uterus after the lower segment operation of 0.4 per cent as opposed to one of 4 per cent after the classical operation. His figures are drawn from three published series of Continental statistics.

A Case of Vulval Carcinoma in Pregnancy.

The carcinoma was first noticed when the patient, aged 45, was two months pregnant. It was a squamous carcinoma. Radical excision of the vulva and dissection of the regional lymphatic glands in the groins were performed at the fifth month and, despite this, the pregnancy continued to term. Delivery was normal. She died two months later with a local recurrence of the growth.

Two Cases of Diffuse Neurofibromatosis with Pregnancy (Recklinghausen's Disease).

The patients were sisters. Their father was also a subject of the disease. Two other sisters and a brother were normal. The one patient had three normal deliveries of unaffected children. The other patient was found to

have a large pelvic neurofibroma filling up the sacral hollow and Caesarean section was performed. The child was apparently normal. In neither case did pregnancy appear to have any effect upon the growth of the tumours.

THREE CASES OF SARCOMA OF THE UTERUS.

The patients survived hysterectomy for 15 months, three months, and two months respectively. The diagnosis was only revealed by microscopical examination, in each case the uterus being removed for a supposed myoma.

TWENTY-SIX CASES OF SODIUM EVIPAN ANAESTHESIA IN LABOUR.

The authors have used this drug on 26 occasions for applying the forceps, repair of lacerations and removal of the placenta; they have not found any attendant ill-effects on either mother or child. They have avoided its use in patients over 35 years of age, or in the presence of toxaemia of pregnancy, hypertension and shock.

THE TECHNIQUE OF THE FRIEDMANN REACTION.

When only a qualitative result is desired Verdeuil uses urine for the injection. He stresses the fact that the amount of hormone in the blood-serum falls rapidly after a meal. After a fast the hormonal content of the urine approximates to that of the blood. If urine is used it is most important to use an early morning specimen. A first injection of five cubic centimetres is given intravenously. The three subsequent injections, each of 15 cubic centimetres, are given subcutaneously. The difficulty of giving four successive intravenous injections is thereby obviated, although the subcutaneous route will not give such a definite result in cases in which the injected fluid has only a low hormonal content.

PREGNANCY AFTER THE INTRA-UTERINE APPLICATION OF RADIUM.

The first case described is that of a woman aged 41, who had been married for 20 years and was childless. In order to check menorrhagia radium was inserted into the uterus, the dose given being 10 M.C.D. (1,333 milligramme-hours R.E.). Amenorrhoea was produced. Twelve months later irregular bleeding recurred and the uterus was curetted. Villi were found in the curettings and the author concluded that the bleeding was due to an abortion at the second month.

The second case was that of a married woman, 39 years of age, who, likewise had never been pregnant. Radium was inserted into the uterus on account of menorrhagia, the dose being five M.C.D. (666½ milligramme-hours R.E.). After the treatment the periods became regular and of normal duration again. Four months later she became pregnant and at term gave birth to a living child, which developed normally.

The paper concludes by a discussion of the question of the normality of children born after treatment by radiation. It would appear that the belief that radiation is followed by foetal abnormalities is largely based on experiences with smaller experimental animals, apart from two cases reported by Pankon and Gummert. The bulk of the clinical evidence goes to show

that such children are normally developed, notably the series compiled by Flascamp, who in 54 cases in which intra-uterine radium had been used and pregnancy ensued found the infants normal in every case.

THE DISSOCIATION OF FOLLICULAR FLUID AND FOLLICULIN.

Moricard has repeated and confirmed Parkes's observation that it is possible to obtain vaginal keratinization in the mouse after complete suppression of follicular activity by X-rays. On correlating this observation with the histological appearances of the follicle, he concludes that the liquor folliculi is not absorbed by the avascular granulosa-cells, but exerts its effects only after the follicle has ruptured. Folliculin, on the other hand, is still present in the vascular theca interna of the irradiated ovary and is responsible for the paradoxical vaginal reaction.

THE ADVANTAGES OF USING A THIN LAYER OF INJECTED FLUID IN THE RADIOLOGICAL EXAMINATION OF THE UTERUS.

The authors, following recent thin layer techniques in the radiology of the intestinal tract, have adopted a similar method for gynaecological radiology. They claim that a more accurate outline of the uterus is obtained with the injection of a small amount of fluid into the uterus without pressure than with a bulkier injection under pressure. They first irrigate the uterine cavity to ensure that there is no obstruction, using two ureteral catheters, size number 16, and then inject three or four cubic centimetres of a 25 per cent colloidal solution of thorium oxide ("Diagnothorine", Rhône-Poulenc).

THE TREATMENT CF UTERINE FIBROIDS AND THE RESULTS OF THE RADIOLOGICAL TREATMENT OF FIBROIDS.

These two papers deal with the relative value of surgery, X-ray therapy and radium therapy in the treatment of fibroids. The authors advocate surgery under the following conditions: (1) Doubt in the diagnosis; (2) degenerative changes; (3) all associated lesions of the endometrium or cervix; (4) lesions of the adnexa; (5) the presence of pressure symptoms; (6) large size; (7) youthful patients; (8) when radiological measures have failed.

A serious error in diagnosis is a possibility in this last group and surgical intervention becomes urgent. In the absence of one of the foregoing indications for surgery, treatment with X-rays or radium should be the method of choice. Radium is to be used in the case of fibroids of average size when bleeding has been severe. In cases in which there is no element of urgency the X-rays are as efficacious as radium and much safer. If radium is to be used Ducuing does not favour its intra-uterine application, considering that there is a small but definite mortality attending such a method. He prefers to use either a vaginal applicator, giving a dose of 20 milligrammes for three or four days, or an abdominal radium pack over the site of the tumour, giving a dose of 100 milligrammes for eight to 10 days. Sometimes a combination of the colpostat with the abdominal pack is employed.

(The author's preference for this technique is difficult to appreciate. Over and above the increased discomfort to the patient from the prolonged dura-

tion of the exposure these methods must combine a very considerable risk of radium burns of the vagina or abdominal wall with a diminished chance of an effective irradiation of the fibroid because of the distance of the radium from the tumour as compared with the customary intra-uterine technique.)

The results obtained with physical methods may be summarized as follows:

X-rays, 82 cases. (*a*) Ovarian insufficiency. Menopausal symptoms usually develop during the course of treatment. (*b*) Control of bleeding. The results are variable. Permanent amenorrhoea, five cases after three treatments; and 51 cases after five treatments. Menses became normal, six cases. Menses returned after several months, 15 cases. Persistence of bleeding, six cases. (*c*) Volume of tumour; the results are variable. No change in 30 cases, marked regression in five cases, slight regression in 47 cases. (*d*) Morbidity. There were not any untoward effects. A cure was obtained in 85 per cent. Of the 12 failures there was an error in diagnosis in six cases, and the other six patients were lost sight of.

Radium, 82 cases. (*a*) Ovarian insufficiency. Symptoms usually appeared within a few weeks of treatment, but in 37 cases actually during the treatment. (*b*) Control of bleeding. Control of bleeding with persistence of the menses, four cases; temporary amenorrhoea, 13 cases; permanent amenorrhoea, 52 cases; persistent bleeding, 13 cases. (*c*) Volume of tumour. No change in 20 cases; marked regression in one case; slight regression in 61 cases. (*d*) Morbidity. One death from embolism, one from septicaemia. Numerous cases presented pyrexia or a vaginal reaction. A cure was obtained in 83 per cent of the cases.

P. Malpas.

La Gynécologie

May 1934.

*Vesico-vaginal fistulae. Reeb.
*Pseudo-ileus of pregnancy. Reeb.
*Cervical carcinoma of the prolapsed uterus. J. P. Tourneux.

June 1934.

*The diagnosis of cancer of the breast. P. Moulonguet-Doléris.
*The operability of carcinoma mammae. Jeanney.
*The present position in the treatment of mammary cancer. A. Gunsett.
A study of sarcoma of the breast. G. Roussy.

July 1934.

*Sarcoma of the body of the uterus. P. Micquet and M. de Lungre.
*Seroplacentol in the treatment of Werlhof's syndrome. Bous Jeyoroff and G. Serdukoff.
The eighth congress of French Gynaecologists and Obstetricians.

Vesico-Vaginal Fistulae.

A series of five cases seen by the author is described, two following vaginal delivery of the foetus, one after the lower segment Caesarean operation, one after total hysterectomy for uterine rupture, and one after the removal of a vaginal cyst. Spontaneous healing, after the use of an in-dwelling catheter, occurred in one case in which the fistula was due to the use of a Braum's hook in embryotomy; the fistula was recognized at the time and would admit two fingers. All cases were treated, by the vaginal route, by separately suturing the vesical mucosa, the fascial tissue, and the vaginal wall; but in two cases it was not possible to suture the mucous membrane of the bladder. All healed with the use of a catheter.

The points emphasized by the author are: waiting for several months following the trauma, preliminary attention to the cystitis, cystocopy, and suture of the vesico-vaginal fascia, exposure being aided by a perineal incision if necessary.

Pseudo-Ileus in Pregnancy.

True obstruction of the pelvic colon by the pregnant uterus rarely occurs. The author reports a case of ileus in a multipara of 33 years at term. She was thought by a midwife to be having false pains. The pulse-rate was 80 and the urine contained albumin. The uterus was constracting and tender at the right upper pole. At first the diagnosis was thought to be detachment of a normally-placed placenta. Distension occurred and a bile enema was ineffective, whereupon it was thought that the case was one either of appendicitis or of ileus. Vomiting supervened and further enemata gave no results. Operation was decided upon and the uterus was emptied under spinal anaesthesia. Hysterectomy was then performed to gain exposure, and the condition was then seen to be ileus, there being uniform intestinal distension without signs of organic obstruction or peritonitis. Under the anaesthetic the bowel emptied itself, and this is suggested as being a useful form of treatment in similar cases. Recovery followed.

Carcinoma of the Cervix in the Prolapsed Uterus.

The literature of this uncommon lesion is discussed and cases reported in the French journals are mentioned together with one of the author's. His patient was aged 60 years, she had long-standing prolapse. It was treated by vaginal hysterectomy. The usual age at which procidentia occurs is from 60 to 70 years, and the disease apparently has a less rapid course than in the ordinary type of case. Why carcinoma is so rare in cases of procidentia is discussed, the main theories mentioned being: (1) The vaginal secretions being exteriorized are less harmful than normal. (2) Venous stasis is common; carcinoma usually arises in less vascular tissues. (3) The age of the patient. (4) The type of epithelium.

The Diagnosis of Cancer of the Breast.

The early diagnosis of cancer and its difficulties are stressed. A discussion in detail between carcinoma, fat necrosis, chronic mastitis, tuberculosis, syphilis, and cysts of the breast is given. The value of the unifocal lesion

of cancer, the nipple signs, and the fact that practically no other lesion occurs in the post-menopausal breast are considered important clinically. Difficulty may be experienced in Paget's disease; carcinoma of the axillary tail, bleeding from the nipple, and in old age when cysts may be simulated. Clinical aids are found in Cutter's method of transilluminating the breast, exploration, and rapid methods of histological examination.

THE PRESENT POSITION OF TREATMENT OF BREAST CANCER.

The author discusses at length the results of all the present methods of treatment. His conclusions are (1) Surgery is best in operable cases. (2) The value of post-operative X-ray therapy is doubtful. There seems to be no difference in the results five years later, whether it is employed or not. (3) The pathological classification in relation to treatment, and prognosis has yet to be fully tested. (4) In inoperable cases radium is best. For recurrences deep X-ray therapy is recommended.

SARCOMA OF THE BODY OF THE UTERUS.

As the authors have seen three cases of this condition within two years they have been impressed by the clinical features. All were treated by hysterectomy. They consider the true frequency of the disease hard to assess unless all uterine tumours are carefully sectioned, it apparently lies between 0.3 per cent and 1 per cent. The typical history is one of uterine bleeding after the menopause accompanied by pain and rapid growth of the tumour. Their cases, however, lead them to believe that about half of the patients are at the menopause or before the menopause. Pathologically, too, it may be impossible to be certain on naked-eye examination as many of the growths are encapsulated. The relation to fibroids has probably been over-stressed; many are merely associated with fibroids, there being no proof of causation. Histologically most arise in muscular tissue, rather than in the tissue of fibroids. Emphasis is laid on several clinical points of value. There are the early onset of pain, the multiparity of many of the patients, the presence of a slightly raised temperature, and the occurrence of attacks of phlebitis. The danger of laying too much faith on negative curettings is mentioned. The prognosis is poor and the type of growth on microscopy is not necessarily an accurate guide. Hysterectomy is the treatment of choice; deep X-ray therapy is not so good.

THE TREATMENT OF WERLHOFF'S SYNDROME BY SEROPLACENTOL.

Seroplacentol is the serum obtained from the placental blood in the umbilical vein which is treated, sterilized and then stored. It is found to produce an increase in the blood-platelets and the erythrocytes. It is, therefore, of value in thrombocyticopenic purpura and kindred disorders. Cases are quoted, some of menstrual excesses accompanied by purpuric lesions and one of its use in the haemorrhagic diathesis of the newborn.

R. K. Bowes.

Zentralblatt für Gynäkologie

No. 29, July 21st, 1934.

Menstruation in a castrated woman after treatment with ovarian hormones. P. N. Damm.

*Unusual delivery in dorso-anterior brow presentation. E. Coester.

The recognition of local argyrosis of the portio vaginalis and in cervical polypi. H. Dworzak.

A congenital dental tumour with absent gums. B. Szendi.

The prophylactic administration of cardiazol for the prevention of foetal asphyxia after thymophysin. K. E. Fecht.

*Coramin in asphyxia neonatorum. J. Giebels.

No. 30, July 28th, 1934.

Final results of Sturmdorf's cervical plastic operation. L. Waldeyer.

A pregnancy calculating apparatus. A. Gengenbach.

*Ammoniacal examinations in eclampsia. J. B. Llusia.

The rheumatic-neuritic-neuralgic-vegetative symptom complex. M. Rodecourt.

New methods in trichomonas therapy. A. Hochloff.

Personal findings with belladonna in obstetrics. O. Weinstock.

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The question of simple or improved examination with the speculum. H. Hinselmann.

Anterior pituitary reaction number 1, and its differential diagnostic significance in arrested extra-uterine pregnancy. W. Spitzer.

Findings with intravenous continuous transfusion in cases of sepsis. E. Kerner.

*Findings with the new hypnotic, *rectidon*, in obstetrics and gynaecology. H. Gamstätter.

Activity of the trophoblast and the Aschheim-Zondek reaction in extra-uterine pregnancy. E. M. Kaplun.

Total vaginal extirpation under intravenous anaesthesia with the help of the writer's injection-apparatus and arm-support. G. v. Bud.

No. 32, August 11th, 1934.

Two cases of genital bleeding in thrombopenia. E. Junghans.

*Carcinomatous development in a maldeveloped uterus (uterus duplex, vagina bipartita). C. Renner.

*The question of radiation therapy of cervical carcinoma during pregnancy. H. Hofmann.

Primary chancre of the portio simulating carcinoma. W. Nissen.

The influence of the ovarian hormone upon the blood-pressure. St. Liebhart.

No. 33, August 18th, 1934.

The treatment of benign genital bleeding with radium. H. Naujoks and H. Hoffmann.

Metreurysis with animal bladders after Baumm. G. Peter.

The tonsils and the breasts at the age of puberty. S. Peller and I. Zimmermann.

Mechanical hindering of delivery in uterus duplex by the non-pregnant uterus. M. Oing.

Solitary cutaneous metastasis in carcinoma of the portio. F. Friedl.

The question of the origin of the gonadotropic active substances in the urine during pregnancy. T. Remzi.

A new automatic apparatus for ligature after abdominal uterine amputation. H. Hillebrand.

No. 34, August 25th, 1934.

*Fundamentals for the clinical consideration of eugenic sterilization. A. Mayer.

What can be learnt from leukoplakia of the penis? H. Hinselmann.

Radiation therapy of inoperable carcinoma of the cervix. F. G. Dietel.

The optimal conceptional time; a fundamental eugenic question for advice in marriage. A. Greil.

Cyclical bleeding in women sterilized by operation as a result of oral administration of hormone. E. Terruhn.

Uterine involution and the lochia after Caesarean section compared with puerperal women fed with a sour and a mixed diet. W. Sperling.

*Chemical uterine extirpation. G. Gambarow.

No. 35, September 1st, 1934.

The prognosis in carcinoma of the portio in the young. G. Frommolt and K. Weninger.

Adrenalin as a biological aid in the treatment of severe cachexia, especially in septic peritonitis. C. Lange.

Is it possible to sterilize male animals by treatment with anterior pituitary hormone? H. Geiger.

Two interesting cases of abdominal pregnancy. F. Meder.

The occurrence and meaning of sudden entry effects. F. Bachner.

A case of congenital subluxation of the joints of the hands. G. Ahltorp.

No. 36, September 8th, 1934.

*Diagnostic fallacies in tubal insufflation. H. Küstner.

*Fatal air embolism after tubal insufflation. O. P. Mansfield and A. Dudits.

The active treatment of septic abortion with tincture of iodine. F. A. Wahl.

Habitual abortion. G. Schwarz.

A contribution on the occurrence of twisted ovarian cysts in children. M. Z. Cervinka and V. Cercek.

Abdominal retractor frame. G. Schubert.

No. 37, September 15th, 1934.

Large cell solid carcinoma of genital glands. E. Fauvet.

Sarcoma of the uterus and vagina. E. Klaften and E. Navratil.

The technique of perforation and cranioclasis of the foetal skull. B. Ottow.

Why is lumbar anaesthesia in Caesarean section particularly dangerous? H. Franken.

Ileus following uterine perforation during the procuring of abortion. W. Jelinek.

Unusual Delivery in Dorso-Anterior Brow Presentation.

Coester describes the case of a primiparous patient who went into labour at term. On admission to hospital in Bonn, 24 hours later, the foetus was found to be presenting by the face. Labour was allowed to continue for 17 more hours, when the foetal heart-sounds began to be irregular and increased to 184 per minute; the patient was then anaesthetized with a view to terminating labour by the application of the forceps to the child's head. The cervix was fully dilated and the foetal head was so low in the pelvis that it was visible during a pain. The presentation was now a brow presentation with the chin directed backwards. The forceps was applied in the oblique diameter of the pelvis and delivery effected by downward traction upon the head, combined with backward rotation, so that the vault of the skull and occipital region could slip out from behind the symphysis; then, with further downward and forward traction, the face and chin were delivered over the perineum. The foetus, which weighed 3,000 grammes and measured 50 centimetres, was delivered in a condition of asphyxia; it recovered, but died 24 hours later. The writer records this case chiefly because of the fact that a brow presentation with the chin directed backwards, contrary to accepted ideas, appeared to cause no particular hindrance to delivery.

Coramin in Asphyxia Neonatorum.

Giebels shortly refers to the use that has been made of coramin in the treatment of both asphyxia pallida and asphyxia livida at the Obstetric and Gynaecological Department of St. Joseph's Hospital in Wuppertal-Elberfeld. By the end of the year 1932, out of 600 births there were 25 cases of severe asphyxia, of which six were of the white variety. An intramuscular injection of one cubic centimetre of coramin was given in these cases; if necessary two more doses, each of half a cubic centimetre, were given at an interval of three of four hours. Other means of treatment of asphyxia, such as tracheal catheterization and warm baths, were also employed.

Coramin was also used in the treatment of cases of asphyxia developing during the first 24 hours after birth. In each case the response to the administration of the drug was very rapid. Ill effects did not result from its administration and good results were more quickly apparent than after giving pituitrin.

Ammoniacal Examinations in Eclampsia.

Llusia has carried out an investigation into the ammonia-content of the blood and urine of eclamptic patients in the Provincial Obstetric Institution in Madrid. For his investigation he estimated the blood-ammonia by Folin's method from eclamptic patients during a fit, from pre-eclamptic patients, and from cases of normal pregnancy with the following results. In normal pregnancy the amount of ammonia in the blood is slightly increased; the increase is greater in pre-eclampsia and very much greater in eclampsia reaching the maximum during the fits. The quantity of urea falls in proportion as that of ammonia rises, so that the quotient of ammonia over urea is increased. During the puerperium the ammonia-content falls

and the urea-content rises until the normal proportion is reached, unless fits occur post-partum, in which case this alteration does not take place until they have ceased.

There is, during pregnancy, a slight tendency to acidosis, which is increased in eclampsia and pre-eclampsia. The cause of the increased quantity of ammonia in the blood is a defect in the function of the liver and not in the kidneys. Ammonia passes over into the foetal circulation and is converted into urea by the foetal kidneys. The placenta neither takes part in the regulation of ammonia in foetal metabolism, nor does it seem to be of importance in the formation of ammonia. Since there is a concentration of ammonia in the blood and in the liquor amnii just before the onset of a fit it is reasonable to ascribe the convulsions to its poisonous action. The remaining symptoms of eclampsia do not appear to have any connexion with its presence in increased amount.

FINDINGS WITH THE NEW HYPNOTIC, RECTIDON, IN OBSTETRICS AND GYNAECOLOGY.

Gämstatter has lately been watching the effects of a new hypnotic which is shortly to be put on the market, under the name of *rectidon*, by the firm of J. D. Riedel E de Haen. The preparation, which is allied to pernocton, is mixed with double its volume of distilled water immediately before use and injected into the rectum through a rubber catheter by means of a syringe, the catheter being passed from 20 to 25 centimetres above the anus. The dose given to an ordinary patient was seven cubic centimetres of the solution, to very strong or excited patients, seven and a half or eight cubic centimetres, and to small or feeble women six to six and a half cubic centimetres. The patient becomes unconscious 15 to 30 minutes after the injection and remains unconscious for three hours; she then graduaaly recovers consciousness. A more marked effect is obtained if a cubic centimetre of dilaudil is given 15 to 30 minutes before the injection of the rectidon. The writer has employed' this drug in 100 deliveries and 40 gynaecological operations. The results have been uniformly satisfactory without any bad effects. Strong uterine contractions have continued, and they have been more effective because the patients have been insensitive to pain. The patients respond to verbal instructions and bear down when told to do so during a pain. Sleep is deep between the pains and returns for several hours after delivery. The children are a good colour at birth and cry immediately.

One hour before the gynaecological operations the patient is given one cubic centimetre of dilaudil followed 15 minutes later with the injection of rectidon. On transfer to the operating theatre she is sound asleep and only needs a minimal amount of ether to maintain complete surgical anaesthesia. Ill effects were not observed, and only one patient vomited on regaining consciousness.

CARCINOMATOUS DEVELOPMENT IN A MALDEVELOPED UTERUS (UTERUS DUPLEX, VAGINA BIPARTITA).

Renner describes the case of a woman aged 47 years who was admitted to hospital in Breslau for the treatment of an inoperable carcinoma of the

genital tract with radium. This woman had had four full-time spontaneous deliveries and two miscarriages, for one of which the placenta was manually removed. Until her examination, on account of malignant disease, there had never been any suspicion that her genital tract was in any way abnormally developed. At this examination, and later at the post-mortem examination, she was found to have a complete duplication of the vagina; a unicornute uterus with a complete portio vaginalis opened into the vault of each vagina. The right vagina was more capacious than the left, which admitted two fingers. Both cervices were the sites of malignant growth through their whole extent; the growth had undergone considerable ulceration. It had further grown upwards towards the uterine body and downwards to involve the septum and both vaginal walls. On naked-eye examination of the post-mortem specimen it was impossible to determine the site of the original tumour as the involvement of both sides was so extensive. On histological examination the growth was found to be a squamous-cell carcinoma which was ulcerated in the region of the portio on both sides and which burrowed deeply under the epithelium of each uterine body and vagina without destruction of the tissues on the surface. The writer considers, therefore, that this was a case of squamous carcinoma of the portio with extension upwards and downwards to the uterus and vagina.

Furthermore, as the growth involved the structures on the right and left sides equally, as well as the vaginal septum, it was impossible to determine whether it had started in one or other portio vaginalis and extended through the septum to the other, or whether there had been two synchronous primary growths, one starting in each portio.

THE QUESTION OF RADIATION THERAPY OF CERVICAL CARCINOMA DURING PREGNANCY.

Hofmann describes the case of a woman of 27 years, with one living healthy child, who presented herself as an out-patient at the German University Gynaecological Clinic in Prag on account of free vaginal bleeding during pregnancy. On examination she was found to be five months pregnant and to have an early carcinoma of the cervix. The patient flatly refused to have the pregnancy terminated or to undergo any operation until the child was born. For this reason she was treated with radium; a dose of 2,040 mgEh was given in two sittings and, as a result, the growth entirely disappeared. The patient returned home and there gave birth to a healthy child at term, labour being so rapid that she had no time to go to hospital for her delivery. Three and a half months later she came up for examination. She was found to be two months pregnant and to have a small eroded patch near the external os. Three weeks later vaginal hysterectomy was performed; a cuff of vagina was removed with the uterus. The ovaries and Fallopian tubes, being normal, were not removed. The mother was well when seen two and a half years later; the child is strong, healthy and well developed mentally for a child of its age.

The writer explains the persistence of cervical carcinoma, which was demonstrated microscopically and the occurrence of a second pregnancy so quickly after radiation, by the inadequacy of the small dose of radium which was applied from the vagina without any intracervical application.

The writer refers to the adverse results to the children following radiation for carcinoma of the mothers during pregnancy, and especially remarks upon the questionnaire of Goldstein and Murphy in America. He considers that while he has had good results in his own case, radiation of uterine carcinoma during pregnancy is not desirable, when it can be avoided, on account of the high percentage of feeble and microcephalic idiots among the children.

FUNDAMENTALS FOR THE CLINICAL CONSIDERATION OF EUGENIC STERILIZATION.

Mayer discusses the difficulties which occur in sterilizing those who are carriers of inherited disease. He points out that the first question to consider in these cases is not how many patients can be sterilized, but how many is it not necessary to sterilize. He would recommend that a thorough examination by an expert gynaecologist should precede any consideration of the desirability of sterilization as this operation, in many cases, may be entirely unnecessary, either because of the woman's advanced age, or some malformation, or some genital defect following inflammatory trouble, all of which conditions in themselves ensure sterility. The absence of inherent sterility being established by some competent observer, the danger of operative interference by the different methods must be considered. There is first the danger of anaesthesia, and, secondly, the operative risk from embolism and peritonitis. A patient who is required to undergo an operation, not for her own benefit, but for that of the State, should not be asked to run any operative risk; for this reason the simplest effective operation should be chosen.

The failure of results of the different operations must be considered so that the procedure with the most certain results shall be chosen. In this connexion he points out the risk of a later pregnancy following Madlener's operation and the possibility of a second operation with termination of an existing pregnancy being called for. It is important that a patient who is to be operated upon for a eugenic reason should not be away from her home longer than is absolutely necessary. It should be remembered, in this connexion, that recovery is more rapid after vaginal operations than it is after abdominal operations. The author considers that such operations should only be entrusted to gynaecologists of high standing who are able to determine the fitness of a patient to undergo an operation with the certainty that there is no pre-existing pelvic inflammatory trouble. These patients should be operated on and nursed in a separate isolated part of a gynaecological department so that they should not have to bear ridicule from other mentally normal patients and be subjects for gossip among these patients and their friends on their return home.

The question of an already existing early pregnancy in a patient in whom sterilization has been ordered calls for further consideration. At present there is no authorization to terminate the pregnancy in the author's country, and yet some operative methods of sterilization may be expected to disturb the pregnancy. Lastly, as the law only considers sterilization for eugenic reasons, what is to happen to those who ask for such an operation for other reasons? Will it also not be possible for fit people to simulate mental or nervous defects with the object of obtaining an order for such a measure?

CHEMICAL UTERINE EXTIRPATION.

Gambarow describes three cases of carcinoma of the uterine body in which the patients were unsuitable subjects for radical operative treatment on account of advanced age and feebleness. In these cases he removed the diseased structures by the intra-uterine application of a caustic with subsequent separation of the slough. For this procedure he employed a pencil, eight to 10 millimetres thick and seven to 13 centimetres long, according to the length of the uterine cavity, composed of 40 parts of zinc chlorate, 10 parts of zinc oxide, and 30 parts of starch. After dilatation of the cervix the pencil is inserted into the uterine cavity up to the fundus. Round this caustic pencil there is a circular destruction of tissue with the formation of a sequestrum which separates and is cast off in eight to 14 days. This is either expelled spontaneously or can be withdrawn with ring forceps.

The sequestrum removed in each case was an entire cast of the uterus including the whole mucous lining and practically the whole muscular coat without its serous covering. A small cylindrical structure, the thickness of the little finger, was the sole remnant of the uterus found on subsequent pelvic examination of these patients. They were not subsequently treated by radium or X-rays. Their histories were as follows.

Case 1. The patient was 76 years old at the time of treatment; she was alive and well without sign of recurrence six years and eight months later.

Case 2. The patient was 70 years old at the time of treatment; she died of abdominal recurrence 18 months later.

Case 3. The patient was 65 years old at the time of treatment; she was alive and well 13 months later.

DIAGNOSTIC ERRORS IN TUBAL INSUFFLATION.

Küstner reports two interesting cases of long-standing sterility in which insufflation was undertaken to determine the patency, or otherwise, of the Fallopian tubes. The first patient was 36 years old and had been married for many years. The Fallopian tubes had been insufflated eight years previously and found to be patent. On pelvic examination an ovarian cyst, the size of a goose's egg, was found. On insufflation under anaesthesia the pressure rose to 150 millimetres, it then fell to 100 millimetres and typical rustling sounds could be heard on auscultation. Air escaped from the cervix when the nozzle of the syringe was withdrawn. The patient did not complain of any pain in the upper abdomen or between the shoulders as is usual after insufflation. Laparotomy was undertaken 48 hours later. The Fallopian tubes were closed and dilated at their outer ends by a mixture of air and fluid. The ovarian cyst and one Fallopian tube were removed; the other Fallopian tube was resected, as it was opened the contained air escaped under pressure.

The second patient was aged 36 years and had been married for 14 years. It is possible that she had gonorrhoea shortly after marriage. Insufflation at a pressure of 250 millimetres was followed by a sudden fall to 100 millimetres without any subsequent abdominal pain or pain in the shoulders. Laparotomy was performed 72 hours later. In this case the Fallopian tubes were both closed and filled with air and fluid. One Fallopian tube and the

corresponding ovary were removed; the other Fallopian tube was resected. The writer considers that the auscultatory sounds he heard were due to the movement of the air in the closed Fallopian tubes.

In future he will not make a diagnosis of patent Fallopian tubes when insufflation is followed by the escape of air from the cervix on removal of the nozzle of the apparatus, or when there is an absence of the typical after-pains in the upper part of the abdomen and between the shoulders on the following day.

FATAL AIR EMBOLISM FOLLOWING TUBAL INSUFFLATION.

O. P. Mansfeld and A. Dudits report the case of a sterile patient of 37 years who had been married for 12 years. Tubal insufflation was followed by death from air embolism. The patient had suffered from ill-health previously, having been operated on for empyema when aged 12 years. Cholecystectomy was performed at the age of 32 years and the appendix was removed at the age of 35 years. She was kept under observation for five days before the insufflation was carried out and nothing abnormal was discovered beyond a small myoma in the fundus of the uterus. At the insufflation a pressure of 110 millimetres was sufficient to demonstrate the patency of the left Fallopian tube and the closure of the right. At this point the patient became cyanotic and died within two minutes in spite of prompt restorative treatment. At the post-mortem examination the uterus was found to be distorted in its upper part by a myoma in the fundus which protruded into the cavity. The right Fallopian tube was closed by a small inflammatory mass and the left Fallopian tube, although patient, was the site of inflammatory trouble. On histological examination caseating tuberculous endometritis and endosalpingitis were found to be present. Insufflation had been carried out under sufficient pressure to cause a defect in the endometrial surface and the entry of air into the underlying veins, the walls of which were weak. In this fatal case the writer considers that the failure to recognize any existing disease was the main contributory cause. Furthermore the pressure was higher than is necessary for diagnostic purposes and too high for safety in a weak uterine wall.

R. H. B. Adamson.

Münchener Medizinische Wochenschrift.

No. 28, July 13th, 1934.

*Myoma simulating pregnancy. A. Döderlein.

No. 30, July 27th, 1934.

*The prophylaxis of eclampsia. H. Siedentopf.

No. 33, August 17th, 1934.

*The promotion of the secretion of milk by anti-thyroid sheltering substance. H. Küstner.

No. 34, August 24th, 1934.

*Experiences with the new spasmolytic *octinum*, with special reference to analgesia in surgery and gynaecology. F. Schulze.

*Uterine rupture during delivery, malpraxis. A. Döderlein.

No. 36, September 7th, 1934.

*The effects of the pure vitamin A, vogan, during pregnancy, compared with the effects of food naturally rich in vitamins. E. Vogt.

*Ureteritis and peri-ureteritis as a cause of gynaecological complaints. W. K. Fränkel.

MYOMA SIMULATING PREGNANCY.

The author discusses the case of a surgeon who was sued for damages for alleged malpraxis. He performed laparotomy on a patient with the intention of removing a fibromyoma of the uterus, but, considering the uterine enlargement to be due to pregnancy, closed the abdomen without further surgical interference. The tumour eventually proved to be a myoma. Döderlein states: (1) There are soft myomata resembling the pregnant uterus even on close inspection after laparotomy. (2) The growth of a myoma may be as rapid as that of the pregnant uterus. (3) The corpus luteum of pregnancy is not to be found in every case; it may be situated internally in the ovary. (4) The palpation of foetal parts is not certain; a hard myoma may very closely simulate a foetal head.

The plaintiff in the case lost the suit.

THE PROPHYLAXIS OF ECLAMPSIA.

The author states that prophylactic measures may be directed along two channels: (1) The selection of women liable to develop eclampsia. (2) The treatment of the pre-eclamptic patient. With regard to the former, he discusses the value of antenatal care as practised in Britain and America. In Germany no such control is exercised on apparently healthy pregnant women who have no complaints. The treatment of pre-eclamptic patients is of two types: (*a*) conservative, and (*b*) active. Conservative treatment consists of rest in bed and scanty fluids. In grave cases the patient is starved. Magnesium sulphate may be given and thyroxin has been suggested by Küstner. Active treatment consists of the induction of premature labour either by medical methods or by rupture of the membranes.

The results were as follows: Seventy pre-eclamptic women were treated and none developed fits. In nearly 50 per cent of cases conservative treatment was considered inadequate and the induction of premature labour was necessary; oedema was readily improved; the renal signs, albuminuria and a raised blood-pressure, were not easily improved; the foetal mortality was 28.6 per cent in cases treated actively and 24 per cent in those treated conservatively.

THE PROMOTION OF THE SECRETION OF MILK BY ANTI-THYROID' SHELTERING SUBSTANCE.

The author discusses the various methods of promoting lactation, and states that, whereas suckling is a good activator of secretion, no drugs are

of any value. The factors to be considered in lactation are: (1) The primary amount of glandular substance: this varies considerably and is largely dependent on heredity. (2) The development of the breasts during pregnancy. (3) The function of the developed gland. Fauver states that development of the lactiferous glands may be effected in animals by the injection of the sexual hormones from the ovary or the anterior lobe of the pituitary body, but that lactation is not produced. The secretion of milk is decreased by thyroid extract. Küstner, therefore, gave antithyroid substances (A. thyronorman, B. diodthyrosin). He obtained good effects in many cases but no effects whatsoever in a few instances.

EXPERIENCES WITH THE NEW SPASMOLYTIC, *Octinum*, WITH SPECIAL REFERENCE TO ANALGESIA IN SURGERY AND GYNAECOLOGY.

Schultze reports his experiences with this drug, methylamino-octen, made by Knoll. He used it instead of morphia. The effect was produced in five to 10 minutes and lasted two or three hours. It was used to alleviate pain after operation, to stop vomiting, e.g. in duodenal ulcer and hyperemesis gravidarium, in dysmenorrhoea and threatened abortion. He states that he obtained good results.

UTERINE RUPTURE DURING DELIVERY—MALPRAXIS.

Deöderlein discusses a case of failed forceps in a patient with a contracted pelvis. The practitioner endeavoured to effect delivery after labour had been in progress for three days. He was unsuccessful and thereupon performed version although the foetus was dead. The body was extracted but the head was left *in utero*. The patient was then sent to hospital, where she died a few minutes after admission. Post-mortem examination revealed a rupture of the uterus, the wound being longitudinal and six inches in length. Döderlein states that the case was seriously mismanaged and that the practitioner concerned was sentenced in court to two months' imprisonment for malpraxis.

THE EFFECTS OF THE PURE VITAMIN A, VOGAN, DURING PREGNANCY, COMPARED WITH THE EFFECTS OF FOOD NATURALLY RICH IN VITAMINS.

Provitamin A is found in fruits and green vegetables. It is probably converted into the true, active vitamin within the body. Vitamin A is found in butter and yolk of egg, in human milk, especially colostrum, and in large quantities in cod-liver oil. It is the vitamin of growth and is found in malignant tumours. It is also present in the pituitary gland. In addition, vitamin A has an anti-infective action; it was given by Green in cases of puerperal sepsis. It has been shown experimentally that animals fed on vitamin A are less prone to infection than control animals. In catarrhal infections, bronchopneumonia and similar conditions in children, good results have been noted as a result of its administration.

Vogt states his experience with vogan in five cases of pregnancy. One tablet was administered three to five times daily. He reports that it has no effect on the general health, weight, blood-picture, labour or puerperium, development of child, or on lactation. He states that cod-liver oil may in-

crease the size and weight of the foetus and has a better effect than pure vitamin A. Fresh vegetables should be given throughout pregnancy.

URETERITIS AND PERI-URETERITIS AS A CAUSE OF GYNAECOLOGICAL COMPLAINTS.

Fränkel states that ureteritis is generally due to inflammation of surrounding tissues and is more common in women than in men. By the excretory methods of urography displacements and irregularities of the ureter may often be diagnosed following parametritis. He believes that inflammation of the ureter tends to persist longer than that of the parametrium owing to the former's continual movement and peristalsis. Fibrotic processes in the parametrium may be followed by displacement, twisting and even compression of the ureter. Fibrous contraction of the urethral wall and swelling of the mucosa may follow. This may be a precursor of hydronephrosis. The author states that the frequency of hydronephrosis in women is due not only to pregnancy, but to these inflammatory processes.

Patients suffering from ureteritis may complain of "pain irradiating to the loins" or, pain at the lower part of the abdomen. Palpation is of very little diagnostic value, but the inflamed ureter may occasionally be felt *per vaginam*. The diagnosis is best made by catheterization of the ureter when the characteristic pain is elicited. The author concludes that the best therapeutic measure is catheterization of the ureters. He leaves the catheters in the affected ureter for five to eight minutes and finds that three or four catheterizations are generally successful.

A. Sharman.

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*The phosphorus content of some female genital tumours. Sodano.
*Menstrual bacteriaemia. Tesu.
*Calcium and potassium and the relation between calcium and potassium in the blood-serum of women with complicated pregnancies. Russo.

THE PHOSPHORUS CONTENT OF SOME FEMALE GENITAL TUMOURS.

The earliest chemical research on neoplastic tissue aimed at the discovery of some chemical substance eventually responsible for abnormal cellular structure and activity. Virchow's theory of tumours led to the abandonment of investigation which had yielded uncertain and contradictory results. It has been found in later chemical investigation that the mineral elements of neoplasms are in general identical with those in normal tissue. They differ only in their proportions. All investgators have noted that in human tumours and in experimental tumours of mice the relation between potassium and calcium is modified. In examining the mineral elements of tumours the greatest attention has been directed to calcium, potassium, and magnesium.

So much study has not been devoted to phosphorus. For this reason Sodano has estimated the amount of phosphorus (after drying and conversion to phosphoric acid) in ten tumours—fibromyomata and carcinomata. He finds that (1) fibromyomata contains a greater percentage of water than carcinomata. (2) There is a high percentage of phosphorus in both types of tumour, but without exception, it is greater in carcinomata than in fibromyomata.

MENSTRUAL BACTERIAEMIA.

It is noted that during menstruation functional changes occur in the other organic systems and that inflammatory processes, acute or chronic, frequently grow worse. The author has investigated the blood-serum and vaginal secretion in 50 women suffering from surgical abdominal lesions, inflammatory or otherwise. Blood was taken for examination in the premenstrual period and on the first and third days of menstruation. Testus results confirm those of Davanzo and Kulka. (1) A transitory bacteriaemia occurs during menstruation, positive in some cases even on the first day. (2) Bacillus coli is a prevalent germ in the blood, but it does not appear contemporaneously in the vaginal secretion. It is, therefore, probable that menstrual bacteriaemia is intestinal (not genital as according to Silva and Gioici) in origin. Appendicular crises often recur in connexion with the menstrual cycle. It is logical to admit that through anatomical and physiological changes in the intestinal walls the epithelium becomes permeable to intestinal flora, which pass into the circulation. A fact in favour of this hypothesis was the isolation of bacillus coli in 11 out of 18 cases and of faecal streptococci in one case.

CALCIUM AND POTASSIUM AND THE RELATION BETWEEN CALCIUM AND POTASSIUM IN THE BLOOD-SERUM OF WOMEN WITH COMPLICATED PREGNANCIES.

Russo describes experimental research on the serum of 36 patients suffering from various diseases complicating their pregnancies. Twenty patients were albuminuric, seven eclamptic, three had hyperemesis gravidarum, and six also had a cardiac lesion. From examination of the results and a comparison with his previous investigation of the blood-serum in normal pregnancy, he concludes that there is an evident hypocalcaemia in all forms of gravid toxaemia. In mild cases the ratio K:Ca differs little from its normal value. But in severe cases the proportion K:Ca is remarkably higher than in normal. It may indeed be consdered an aid to the prognosis and diagnosis. The causes of this altered ratio in eclampsia, albuminuria, and high blood-pressure, are probably of long standing.

J. H. Filshill.

Annali di Ostetricia e Ginecologia

THE AVERAGE LOMBARDIAN WOMAN AS AN ANTHROPOMETRIC TYPE FOR OBSTETRIC AND GYNAECOLOGICAL INVESTIGATION IN LOMBARDY.

*An experimental investigation of ovarian hormonal activity in women suffering from fibromyoma. Crispolti.

*Venous pressure in relation to normal pathological and experimental conditions in non-pregnant women. Valle.
Elastic fibres in the gravid uterus. Carreti.
Vulval tuberculosis. Natale.

ANTHROPOMETRIC INVESTIGATION OF THE AVERAGE LOMBARDIAN WOMAN IN RELATION TO PHYSIOLOGY AND PATHOLOGY.

Colloridi refers to the great importance recently attributed to anthropometric study in determining physiological phenomena, such as fertility and the liability to certain forms of disease. As a preliminary to research on the aetiology of uterine myomata he has carried out an extensive series of anthropometric methods, tabulating and comparing his results with those of Viola, Boldorini, and others in Italy, and with Quetelet's in Belgium. Many genital diseases seem an almost inevitable consequence of certain organic constitutions. In a subsequent work Colloridi hopes to indicate the predominant constitutional signs related to the appearance of such diseases as uterine fibromyoma.

The aim of Crispolti's research has been to determine approximately, and by actual experiment, the degree of ovarian hormonal efficiency in sufferers from uterine fibromyoma. His conclusions are based on the eventual influence induced in the genital organs and endocrine glands of laboratory animals after injection of an extract of the whole ovary from fibromatous cases. The animals selected were immature white mice and guinea-pigs in various stages of sexual life. The results obtained show that the ovaries of the woman contained secretions which were only partially ovarian in origin. In immature guinea-pigs uterine changes could not be found after injection, and the changes in the ovaries and other endocrine glands were variable. These findings suggest that hormones, other than the ovarian hormones, had been received from injection.

From the clinical experience of others, and from his own observations and experimental results, Crispolti concludes that fibromyomata cannot be exclusively due to disordered ovarian hormonal activity. The condition of uterus affects the ovary. There is probably a reciprocal action and fibromyomata originate from abnormal stimuli due to a complex disturbance of the whole endcroine system.

VENOUS PRESSURE IN RELATION TO NORMAL PATHOLOGICAL AND EXPERIMENTAL CONDITIONS IN NON-PREGNANT WOMEN.

Valle notes that while investigations of venous pressure in obstetrics have been numerous they are somewhat scarce in the gynaecological field. He has made three successive determinations of venous pressure in 314 women, and has drawn up his results in relation to age, constitution, parity, various phases of the menstrual cycle, the physiological menopause, the surgical menopause, anaesthesia, gynaecological operations, the action of hypophyseal and ovarian hormones, and gynaecological pathology. He found that the average venous pressure in 53 healthy, non-pregnant women, taken in the intermenstrual period with Ruffini's apparatus, was equal to 91 millimetres of distilled water. This average value is lowered with advancing years, but shows no relation

to the morphological constitution. In multiparae, the venous pressure is lower than in multiparae of the same age. In most cases (73 per cent) it is diminished in the premenstrual and increased in the menstrual period. It increases during the physiological climacteric and after bilateral oöphorectomy. Incomplete castration causes no marked change. In primary ovarian insufficiency the venous pressure varies according to the type of patient. In the macro-splanchnic it is increased. In the infantile type, with congenital hypoplasia, it diminishes. In retroversion, prolapse, uterine carcinoma, a marked deviation from the normal pressure is not noted, but in cases of ovarian cyst there is a slight increase.

General anaesthesia usually determines a rise in the venous pressure; lumbar anaestheisa causes a decrease; and basal anaesthetics, such as avertin and morphine, cause oscillations leading to a slight increase. Variations in venous pressure do not seem to be influenced by the length or gravity of abdominal operations. The intramuscular injection of an extract of the posterior lobe of the pituitary gland causes an abrupt rise of both venous and arterial pressure; the former decreasing rapidly, the latter gradually. Intramuscular injection produces a similar though less marked effect. The hormones of the anterior lobe of the pituitary gland, the corpus luteum and the Graffian follicle cause a slight fall in the venous pressure. The sum of all the investigations seems to prove a close relation between the genital function and venous pressure. Variations in the blood-pressure indicate that vasomotor disturbance depends on endocrine crises with the condition of the genital glands as a central and predisposing factor.

J. H. Filshill.

REPORTS OF SOCIETIES.

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY.

A Meeting of the Society was held at Leeds on April 28th, 1933.

DR. C. H. WALSH, of Liverpool, read a paper on

HYDROCEPHALUS: A METHOD OF TREATMENT

Mrs. M.J.S., a primigravida, aged 31 years, was admitted to Mill Road Infirmary in labour on April 16th, 1933.

She was at full term and stated that labour pains started at 11 p.m. on April 15th, but were slight, and at long intervals. On admission to hospital her general condition was excellent. The membranes ruptured spontaneously at 5.30 a.m. on the 16th. There was no evidence of hydramnios. Pains continued to be weak and at long intervals till the afternoon of the 18th, *i.e.* 54 hours after rupture of the membranes. I saw her at this stage. By abdominal examination the foetus was presenting by the head, which was above the brim of the pelvis and extended to the level of the umbilicus. The head had the feel of a tense cyst. Foetal heart-sounds were present and regular. Vaginally the os was barely one finger dilated. A diagnosis of hydrocephalus was made and confirmed by radiograph.

Treatment

After emptying the bladder by catheter 1 c.c. of 2 per cent Novocain was injected into the skin and tissues of the abdominal wall midway between symphysis and navel. A lumbar puncture needle was then plunged through the abdominal wall and uterus into the hydrocephalic head. On withdrawing the stilette cerebro-spinal fluid escaped under pressure and was aspirated by syringe. Thirty-eight ounces of cerebro-spinal fluid were withdrawn without the slightest difficulty. Another radiograph taken at this stage shows the collapsed head entering the brim of the pelvis. One-half c.c. of pituitrin was given; uterine action commenced; contractions were regular and strong and the foetus (stillborn) was born at 8.5 p.m., i.e. three hours after aspiration of the head. The placenta followed normally. The foetus was a typical hydrocephalic male weighing 5 lb. without its two pints of cerebro-spinal fluid, and was 18½ inches in length. It had associated spina bifida and talipes. Examination of the cerebro-spinal fluid showed a slight increase of protein content and slight decrease of chlorides. Wassermann reaction was negative. Convalescence of the patient has been perfectly normal.

The interesting features of the case are:

1. The long first stage with practically no dilatation of the os.

2. High presentation of the head making tapping of the skull vaginally not an easy procedure under general anaesthesia as compared with the easy route through the abdominal wall.

3. The successful termination of labour within three hours of aspiration of the head without any vaginal interference.

Conclusion

A method of treatment of hydrocephalus, when the head presents in labour, by aspiration of the cerebro-spinal fluid through the abdominal wall is demonstrated in this case. The procedure is safe, easy, and clean.

I can find no reference in the literature on this subject regarding this method of treatment though most authors stress the difficulties of diagnosis and the dangerous complications which might occur.

Discussion

The President congratulated Dr. Walsh on his paper.

Mr. Stacey also congratulated Dr. Walsh on his paper. He pointed out that acu-puncture of the abdomen is a reasonable procedure with no ill effects in cases such as these described by Dr. Walsh. He cited the cases of hydramnios treated in this way by Rivett and reported by him to the Congress. He also had carried out this procedure in several cases of hydramnios.

Mr. St. George Wilson defended the procedure of acu-puncture for hydramnios and hydrocephalus. He thought it would be of vast use in cases of hydrocephalus where there was extreme distention.

MR. WM. GOUGH, of Leeds, cited a case of

OVARIAN PREGNANCY

E. F. Aet. 21.

Menstrual History.

Age on onset—11.

Normal cycle 5/28. Amount lost—normal. No pain.

Last menstrual period—nine weeks before admission.

Married six weeks. No children or abortions.

History.

On December 30th, after nine weeks amenorrhoea she began to have a slight bloodstained loss *per vaginam*. This continued without any other symptoms till 6 p.m. on January 1st, when she began to have severe abdominal pain (lower abdomen) with vomiting. The pain continued till she was admitted at midnight the same night.

Condition on admission.

Pale and definitely anaemic.

Temperature, 97.2. Pulse, 140. Respiration, 30.

Abdomen. Rigidity and tenderness of lower abdomen.

No *per vaginam* examination was made, as immediate operation was undertaken.

Operation.

A right paramedian incision (subumbilical) was made. The peritoneal cavity was opened, and blood immediately gushed out. This was mopped up and the right adnexae were delivered from the abdomen. Their condition was as follows: the Fallopian tube was normal, but the ovary had attached to it at the point of attachment of the ovarian ligament a round red mass the size of a golf ball. A rupture had taken place at one point. The mass was excised, the attachment to the ovary being secured by ligatures.

The left adnexae were inspected and found to be normal. Some blood and clot were mopped out of the peritoneal cavity, and the abdomen was closed in layers. The condition was thought to be either a ruptured follicle or a ruptured ovarian pregnancy. The specimen was microscoped.

Histological report.

"A cystic space is present, containing blood clot. Chorionic villi and syncitial tissue are present in the clot. Some organization is taking place in one part of the periphery. Part of the wall is very thin, but ovarian stroma is definitely present in some parts".

Subsequent history.

After mild pyrexia for ten days the patient made an uneventful recovery.

Discussion.

The President thought this was a true specimen of ovarian pregnancy. He said that the condition was relatively rare, and when he presented such a specimen some years ago he found in the literature 60 cases.

Mr. Alfred Gough, of Leeds, cited a case of

Carcinoma of Cervix with Pregnancy: Wertheim's Hysterectomy

Mrs. M. G. aged 37, 7-para, sought advice on account of stabbing pains in the lower abdomen, backache, and discharge of a creamy and offensive nature. There had been amenorrhoea for three months.

The size of the uterus corresponded to a three months pregnancy. There was a hard friable growth of the cervix with ulceration. The diagnosis was confirmed by a biopsy, which showed a squamous carcinoma with keratinization in parts. The patient at first declined any further treatment, and consented only after a delay of a month. She was then four months pregnant.

The routine treatment of carcinoma of the cervix with radium was departed from in this case on account of uncertainty as to its effect on the foetus. It is well known that X-ray treatment may have deplorable results for the developing foetus—causing malformations and mental deficiency—

but there seems to be little definite knowledge of the effect of radium. One would fear that both forms of radiation might produce similar results, so it was decided to treat this case by operation.

On 22/4/32 an extended hysterectomy by Wertheim's method was done. The operation was facilitated by the looseness of the connective tissues due to the pregnant state. On the other hand, the increased vascularity of the pelvic organs rendered more difficult the control of the bleeding.

The patient was critically ill for some time on account of urinary infection and anaemia, but she ultimately made a good recovery, and was quite well when examined six months later.

MR. ALFRED GOUGH, of Leeds, cited a case of

MIXED TUMOUR OF UTERUS (Leiomyo-myxo-sarcoma)

Miss H. S. aged 23, was sent to me on account of increased size of the abdomen, which she had noticed for 15 months. The menses had become more frequent, occurring at intervals of 14-21 days, but the amount lost was not increased.

On abdominal examination, the tumour mimicked a pregnancy in a remarkable way. The size was approximately that of a pregnancy at full term. The consistence was generally soft and elastic, with some firmer parts. At the fundus was a rounded prominence resembling the breech of a foetus, and in the hypograstrium there was another rounded mass very much like a foetal head. There was no fluctuation, and no evidence of free fluid in the peritoneal cavity. On examination from below, the findings were totally different from those of pregnancy. The cervix was small and firm, and the pouch of Douglas was filled by a tense rounded swelling. A provisional diagnosis was made of ovarian tumour, probably malignant.

At the operation (27/3/33) the abdomen was opened by an incision extending from the pubes to a hand's breadth above the umbilicus. The tumour at first sight looked just like a pregnant uterus—smooth, purple and soft—but further investigation showed it to be a tumour of the uterus. The ovaries were three or four times the normal size, and, as the tumour was obviously malignant, they were removed along with the uterus. There were no adhesions. The only difficulty was due to the greatly enlarged blood-vessels, and haemostasis needed special care. The operation caused hardly any shock and an uneventful recovery followed.

The tumour weighed 17½ lb. (8 kg.). It roughly retains the pyriform shape of the uterus and there are large smooth lobar prominences. On section there is seen to be a diffuse neoplastic change which involves almost the entire uterus. Some parts are firm like a myoma, other parts are soft, and some are quite brain-like.

The histological report (by DR. R. CARMICHAEL) states: "This is a tumour of malignant character of muscular origin. The histological character of the tissue varies greatly even within small areas, the growth being composed of cells which vary from fully differentiated plain muscle fibres through grades of increasing malignancy down to small round cells of

completely undifferentiated type. There is advanced myxomatous degeneration of much of the tumour substance. The enlargement of the ovaries appears to be entirely due to a patchy myxomatous degeneration of the ovarian stroma."

Discussion

The PRESIDENT suggested that the Society should at some future date discuss this important subject of the treatment of carcinoma of the cervix during pregnancy. It might be worth while comparing the results of Radium therapy and Wertheim's hysterectomy.

MR. ST. GEORGE WILSON described a successful case treated by radium. The child died at the tenth month.

MR. W. GOUGH criticised his brother for not having ascertained for the last six months whether his patient was alive or not, and said that in his experience, however treated, cases of carcinoma of the cervix during pregnancy died within one year of treatment.

MR. A. A. DAVIS, of Manchester, read a paper on

THE PRESACRAL NERVE

The Surgery of the Sympathetic Nervous System has provided one of the most fruitful of therapeutic fields within recent years, and it was inevitable that its application to strictly gynaecological problemt should be sought with increasing interest. Hitherto, work on this particular aspect has been limited almost entirely to the Lyons School of Surgeons in France, but of late, discussion in this country has been much in evidence, more particularly in connection with that part of the pelvic sympathetic system which has been called by Latarget the "Presacral Nerve". As a preliminary to surgical intervention we have endeavoured to establish a reasonably standard anatomical description of this structure, and I propose this evening to consider this anatomy in some detail, and then to survey rapidly the modern knowledge of physiology of the nerve, its pathology and the technique of its resection; together with the published results of the operation.

The exact configuration of the presacral nerve has given rise to more controversy amongst anatomists during recent years than almost any other subject, and although much of the disagreement is academic, the basis is of paramount importance to the surgeon, who necessarily wishes to know what the structure he is attempting to remove looks like. The older anatomists described it vaguely and under a variety of names. Haller, Sappey, Tiedmann, Valentin,and Schwalbe, all described it as a complicated plexus, the continuation or the so-called "pre-aortic plexus", (a structure which actually does not exist). Lee described a single nerve, Hirschfeld a wide plexiform nerve, Henle two widely separated parallel intercommunicating nerves, Swan and Beck a wide plexus of many fine parallel nerves, and Dahl both illustrate the arrangement of the parallel nerves originally described by Swan and Beck, while Deaver and Ranson similarly repeat Sappey's initial "spider's web" description. It is however only in recent years that any very definite attempt at careful investiga-

tion into the anatomy of the plexus has been undertaken, most notable amongst these researches being those of Hovelacque, Latarjet, Segond, Roussel, Ferey, and Kalberg. Painstaking and exhaustive though this work has been—and possibly because of these factors—the variations in the findings of different writers on the morphology of the plexus are even wider than those exhibited by the older authors. According to the former, the plexus may present itself as a single median nerve or as a widely-meshed plexus occupying all the space between the common iliac arteries, with all variations between the two extremes. Some idea of the extent of this variation may be obtained from the following analysis of the findings of different workers:

Hovelacque from his investigations in 100 dissections, concludes that though it may be single, double, (occasionally appearing as a single trunk with two lateral smaller ones joining above and below), or a plexus, it is "usually a widely-fenestrated plexus of several main trunks". Kalberg investigated the anatomy of the plexus in 38 dissecting-room cadavers of all ages, varying from one month to 78 years. In 23 cases a plexus of three or four parallel intercommunicating nerves was present. In seven, two single (larger) nerves ran nearly parallel over the fifth lumbar vertebra, meeting for a short interval at the middle of their course. In only eight was the plexus represented by a single nerve, and of these, four were in females. Chianello in 32 cadavers found a plexus in 53 per cent, a single cord in 22 per cent, two groups of nerves in 15 per cent, and two single nerves in 10 per cent. Delmas and Laux found a true plexus formation in 80 per cent of 20 dissections, with a single nerve in the remainder. Cordier dissecting eight bodies encountered the plexus in all cases as a "flat irregular band, made up of dense fibres united to each other by short anastomoses and fibrous tissue". Latarjet has repeatedly asserted his belief that it usually manifests itself in the form of his single "presacral nerve", an opinion which, though formerly adopted by his surgical colleague Cotte has latterly been discarded by that authority in his modified operation for resection of the presacral nerve, the technique of which is based on the occurrence of more than one nerve in the plexus. Bergier and Morrison-Lacombe both agree with Latarjet's conception of the single nerve. Roussel found "a single cord" in 75 per cent of his dissections, "a wide plexiform cord" in 25 per cent and "a widely-meshed plexus" in five per cent. The same author quotes Le Grand to the effect that in four patients upon whom that surgeon performed the operation of presacral sympathectomy, the nerve presented itself as a clearly-cut cord in three, while in the fourth there was a wide plexiform arrangement. Ferey from the result of his dissections in 15 cadavers, would entirely reverse Roussel's figures. He found a plexus present in 13 cases (85 per cent), two cords in one case, and a single nerve in the last. He considers that in the majority of cases, the plexus exhibits itself either as a flat plexus (33 per cent) or as several fine parallel nerves (55 per cent). Jianu, Tzovaru and Bratiano examined nine presecral nerves removed by them at operation. In all cases there were "several fairly big nerve bundles of three to five mm. in width with fine transverse anasto-

moses, the whole forming a wide sheet" named by them the "presacro-lumbar plexus". Bernard and Theodoresco in their operative series, found "seven or eight fine filaments" in four cases, "two fairly big nerves" in three, and three fine parallel nerves in an eighth. Laux states that a plexus is present in 80 per cent of cases, and a single nerve in the remaining 20 per cent. Learmonth quoting a similar percentage, suggests that the "usual" arrangement found at operation is one of two parallel nerves with many intercommunications. Delmas and De Rouville stressing its variability, state that the plexus "usually" takes the form of "a plexus of anastomosing nerves in a fine connective-tissue sheet triangular in shape, the fibres being condensed at the border of the triangle. . . . A single nerve is unusual." Segond found in his dissections that the plexus presented itself "much more often as several multiple nerves than condensed into a single nerve". Mornard did not find a single nerve in any of his three operative cases, and considers it the "exception" to find one. Binet and Beau consider that a single presacral nerve is "exceptional". Hartmann-Weinberg investigating the anatomy of the plexus in man and the anthropoids, found it to consist in all cases of a series of from three to five fine parallel nerves. Fontaine and Hermann state that "It has been our experience that the nerves are usually in plexus formation, and rarely combined into a single trunk".

The foregoing résumé reveals a variety of opinions on the anatomy of the superior hypogastric plexus almost bewildering in their apparently fundamental differences. A considerable number of competent authorities are shown to have investigated the question in both its anatomical and surgical aspects, yet though collateral work exhibits fairly general agreement concerning the origins and connections of the plexus, the actual form it adopts, both in the cadaver and at operation, remains the subject of the liveliest disagreement. Every type of nerve arrangement has been found by different observers, each of whom suggests that the conformation described by him is typical of the majority of cases. There would appear no possibility of correlating these separate opinions, but it will be noticed that most of the later work, emanating as it does from the two great French schools of neurological anatomy at Paris and Lyons, has tended to drift into a series of verifications and contradictions of the original findings of their respective directors, who may be taken as represnting the extreme of modern opinion on the subject—very adequately expressed by Latarjet's denomination of "presacral nerve" as opposed to Hovelacque's "superior hypogastric plexus".

Which then of these two divergent views is the correct one, and in what way has the difference arisen? In an attempt to elucidate this problem I recently made a series of 60 dissections in cadavers of various types, foetuses and stillborn children. In addition the presacral nerves removed at operation were teased out for the same purpose. I found a variety of types of plexus or nerve present as wide as that I have already recounted, but providing a fairly easy basis for classification. Before proceeding to this, however, I should like to show you some photographs and drawings illustrating the extremity of this variety.

It will be noticed that in fresh specimens and in the case of the opera-

tive pieces, a plexus is usually found, and not a single presacral nerve, and I believe that this fact provides one of the solutions to the controversy. I don't think there is any doubt that condensation of the connective-tissue in which the nerves of the superior hypogastric plexus lie, occurs to a more considerable extent than has hitherto been recognised, accounting for the high incidence of apparently single presacral nerves in preserved specimens. This is further illustrated by the fact that often an apparently single presacral nerve can often be further dissected without much trouble into two or more constituents. In short, age and preservation may convert a true superior hypogastric plexus into an apparently single presacral nerve, while close dissection may reverse the sequence. It would appear, therefore, that the variations described by different authors are the result of different standards rather than of different observations. The question remains, which of these standards is the one to be accepted? Latarjet claims that the fine dissection which subdivides his presacral nerve exceeds the limits of ordinary anatomical separation, but the comparative ease with which this may be accomplished, as compared with the difficulty in separating a peripheral spinal nerve into its constituents, negatives such a statement almost completely. Furthermore, from the surgical standpoint—and it is here that precise detail is so important—the infrequency with which a single nerve is encountered at operation has been emphasized by almost all authorities, including Cotte himself. It is inevitable, therefore, that Latarjet's standard must be rejected on all grounds, and that description based upon more complete dissection of the plexus remains the only accurate index of its morphology. (This, however, by no means excludes the advent of a true single indivisible presacral nerve in a not inconsiderable number of cases—see below). Using this index, my own cases may be classified and enumerated as follows:

Taken separately, the nerves removed at operation were arranged in nearly all cases in a complicated plexiform manner. Whether this was the effect of excessive teasing-out, or whether it represents a true anatomical picture, it is difficult to say, but one is inclined, in view of the other findings recorded above, to suspect the former of playing a considerable part in the result, which should therefore be taken reservedly. Perhaps the same fallacy is responsible for the similar reports of other writers

The Relations of the Plexus:

The superior hypogastric plexus lies behind the peritoneum, somewhat to the left of the middle line, upon the bodies of the fourth and fifth lumbar vertebrae, from which it is separated by a dense sheet of fibro-cellular connective tissue. This fibrous lamina is easily separable from the plexus throughout the latter's course, and is similarly separable from the lumbar vertebrae behind, the middle sacral artery intervening between it and the bone in the mid-line. Below the promontory it rapidly becomes adherent, eventually merging with the sacral periosteum. The anterior surface of the plexus is covered similarly by a finer but still definite layer of connective tissue, the locally condensed subperitoneal areolar tissue. The two laminae fuse at the lateral borders of the plexus, which is thus isolated within a

fibrous sheath. This disposition is of considerable practical importance, as it allows of complete extirpation of the plexus without isolation of its constituent nerves or of danger to the subjacent vital structures (providing that rupture of the middle sacral artery is eliminated by avoiding encroachment below the promontory). The relation of the plexus to the great vessels varies with the level of the aortic bifurcation and the direction of its branches. In the adult the level of the bifurcation is more variable than is usually appreciated, with the result that the plexus may be entirely pre-osseous or entirely pre-venous, with intermediate variations. As a rule, half of it lies upon the left common iliac vein and half upon the bone. In old age, deformity and arteriosclerosis distort the iliac vessels considerably, and the subsequent assymmetry is responsible for a certain amount of relative variation. The pelvic meso-colon with its contained vessels is usually situated completely to the left of the plexus. In some cases, however, (Roussel 15%, Cotte 1%, Elaut 8%, Bernard 1 case, my own series 2 cases) it transgresses the mid-line, and lies directly anterior to the plexus, which can then only be reached by incision through the two layers of the meso-sigmoid and dissection between its contained vessels. The left ureter is similarly usually situated well to the left of the plexus, but in those cases where the latter is displaced leftwards, it may attain a very close relation. In a case described by Bernard and Theodoresco, the third part of the duodenum completely covered the promontory. I have never encountered this rare relationship, but its occurrence is of importance from the surgical point of view.

Physiology

Considering the obscure state of our knowledge of the physiology of the sympathetic system in general, it is hardly surprising that the physiology of the presacral nerve in particular should be almost unknown. But I should like to draw your attention to one or two facts of significance in this connection.

1. One third of the fibres in the presacral nerve are centripetal.

2. Katz, Meltzer, and Rotter have shown that Lennander's original idea that the viscera are insensitive to ordinary stimuli, was wrong. Anatomically, this means that the sympathetic must be viscero-sensitive.

3. Section of the presacral nerve relieves pain in the pelvic viscera.

4. A painless and precipitate labour followed resection of the presacral nerve in a case of Dr. Addis's.

5. Following resection of the presacral nerve, the bladder and rectum show increased frequency and ease of emptying.

6. Resection of the nerve appears harmless to all the pelvic functions.

Indications of Operation

These may be classified as follows:

1. Severe dysmenorrhoea which has not reacted to medicinal and minor surgical procedures.

2. Severe intractable pelvic neuralgias.

3. The cystalgias and pelvic neuralgias of inoperable pelvic carcinoma.

4. Intractable pruritus vulvae and ani.

5. As a corollory to other operative procedures in cases of long-standing pelvic pain.

The Operation

Although Cotte originally performed and described the operation of resection of the presacral nerve, his method is really merely a slight modification of one devised by Leriche, who, however, did not lavish much of his usual enthusiasm upon it. The actual technique and difficulties of the operation have been recently described by one of us, and only an outline may be suggested here.

The Results of the Operation Published to Date

You will notice that Cotte himself is responsible for about half the number of operations, and that his results are magnificent. Most of the rest show extremely good results, although Fontaine (not included) had a death. But most of the periods of follow-up are extremely short, and their authors hyperenthusiastic, and close examination often reveals that the word " cure " has been used somewhat elastically. Again, in nearly all the published cases some other often major operative procedure accompanied the resection of the presacral nerve, a very fallacious detail. But the operation does appear to have a definite sphere of application in occasional cases, where its results may be striking, and one feels certain that with the wane of the present wave of enthusiasm the procedure will be included with the rapidly diminishing list of benificent surgical operations.

Discussion

The PRESIDENT congratulated Mr. A. A. Davis on his excellent paper which must have necessitated so much work, including no less than 70 dissections. He said the Society would look forward to his clinical results and any further investigations which he might undertake on this subject.

Mr. W. GOUGH suggested that if the operation of " presacral sympathectomy " cured cases of pruritus vulvae it was a most valuable operation.

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY.

A meeting of the Society was held at Sheffield on November 24th, 1933.

MR. A. A. GEMMELL, of Liverpool, cited a case of

UTERINE PROLAPSE IN THE NEW-BORN CHILD

The following are some notes on a case of UTERINE PROLAPSE IN A NEW-BORN INFANT which I was asked to see in Dr. Murray Bligh's ward at the David Lewis Northern Hospital, Liverpool. I am grateful to Dr. Murray Bligh for his ready concurrence that I should report the case to our Society.

The child was born at 8.30 a.m. on January 4th, 1927. It presented by the vertex in the L.O.A. position. It was at once seen to have a large spina bifida in the lumbar region and was admitted to Dr. Murray Bligh's ward on that account.

About 10 p.m., on January 8th, 1927, it had a long bout of crying, and after this a "lump" was noticed at the vulva. I saw it next day and the cervix was protruding from the vulva for about a quarter of an inch. The prolapse could be reduced but immediately recurred. A pad was kept on the vulva, secured in place by the napkin. The condition of the child was so poor, on account of the spina bifida, that no further treatment of the prolapse was considered.

On January 21st, 1927, the prolapse spontaneously disappeared and never re-appeared up to the time of the child's death on March 20th, 1927. A post-mortem examination was carried out ten hours after death. After opening the abdomen the prolapse could not be reproduced by pushing down the uterus from above. Both kidneys were lying lower than normal and were cystic; both ureters were dilated and two-thirds of the bladder lay above the level of the symphysis pubis. The spina bifida was associated with a meningo-myelocele at the level of the lumbo-sacral junction.

Ballantyne, in his *Antenatal Pathology and Hygiene—The Foetus* (1902) records two cases of uterine prolapse in the new-born and refers to ten other cases. Of these twelve cases, the presentation was a vertex in ten and a breech in two. The infants were all born alive, but, with one exception, died some time later. The condition was associated with a lumbo-sacral spina bifida in all but two cases. In all the prolapse was easily replaced and in none had it anything to do with the death of the child.

In this type of case there must be a defective nerve supply to the supports of the uterus and possibly defective development of the pelvic cellular tissue and muscular floor. Probably similar factors are present in cases of nulliparous prolapse in adult life, but in two or three such cases that I have had X-rayed there has been no evidence of abnormality of the spinal column.

Discussion

The PRESIDENT (Mr. LEYLAND ROBINSON) commented on the rarity of this condition. He thought that in all probability it was not a true congenital prolapse, but rather an extreme example of muscular weakness. He thought that there was also a very definite nervous factor in such cases through faulty innervation as the result of the spina bifide.

Mr. W. W. KING asked why it was impossible to reproduce the prolapse after death. Mr. Gemmell had stated that this was not possible but had not stated why it had been impossible.

Professor DOUGAL referred the Society to the Manchester specimen of congenital prolapse. He thought it to be due in part to congenital weakness of the pelvic floor and stated that he believed many cases of nulliparous prolapse were the result of congenital weakness.

Dr. E. A. GERRARD also thought that in all probability the pelvic floor in such cases was congenitally defective and quoted a case in a young woman on whom colostomy had been performed for imperforate anus.

Mr. A. A. GEMMELL, in reply, stated that in none of Ballantyne's 12 cases was the prolapse present at delivery. He thought that the reason why it was impossible to reproduce the prolapse after death was because of *rigor mortis*. He suggested that in cases of nulliparous prolapse it might be advisable to take an X-ray of the lumbar spine for evidence of spina bifida.

MR. GLYN A. DAVIES, of Sheffield, cited a case of

AN UNUSUAL FOREIGN BODY IN THE BLADDER.

M.P.H. 61/33—Case of Mrs. D., aged 43, who had a Stage 1 Carcinoma of the Cervix. She was treated with radium by Heyman's technique. Some little difficulty had been experienced in persuading the patient to come into hospital for the third dose, as she had some trouble at home and found it difficult to leave.

The third dose of radium was inserted on March 24th, 1933 (125 mgms. for 22 hrs. = 2750 mg. hrs.). During the night a glass catheter was passed and on withdrawing the instrument the nurse was alarmed to find that it had broken off and the top end was missing. The House Surgeon was called and thought he could feel the broken end in the urethra through the anterior vaginal wall. In the morning the radium was removed, and the dressings searched and kept. No sign of the catheter was discovered and it was concluded that it was either still in the urethra or had passed into the bladder. A little later the patient passed urine naturally, thus settling the point for us. She had no symptoms of any kind and the urine contained no blood or any other abnormality. The patient was perfectly well aware of what had happened and was mainly agitated as to how long it would be before she got out again—an agitation shared by ourselves. The night nurse was in a state of mild hysteria.

It was decided to X-ray the patient in the hope that the foreign body would show. Before doing so, it was thought advisable to pass a cystos-

cope, and this was done under gas and oxygen anaesthesia. Mr. Chisholm very kindly helped in this, and was successful in discovering the broken end; it lay with the jagged end downwards, equidistant about an inch above the inter-ureteral bar and from the left ureter.

Mr. Phillips was away, and on his return that evening advised me to do a supra-pubic cystotomy the next morning. This was arranged for 10 a.m.; at 7 a.m. I was telephoned, and very much to my relief and delight was informed that the woman had passed the catheter spontaneously. She made a completely uneventful recovery.

Conclusions

I think this case raises points as to:

1. Whether glass catheters should be used at all, and

2. If they are used, and are broken off, is one entitled to wait, and if so, how long?

Discussion

The PRESIDENT (Mr. LEYLAND ROBINSON) remarked on the interesting nature of the case and stressed its importance as an accident that might happen at any time. For this reason he agreed that it would be as well if a definite form of treatment for such a contingency could be defined. He suggested that if it should prove necessary to open the bladder that vaginal cystotomy would be preferable to supra-pubic cystotomy.

Mr. JEFFREASON deprecated the use of glass instruments, which he stated were most dangerous and quite unnecessary. He recalled having once found a piece of a glass Ferguson speculum in the upper vagina, and pointed out that the glass might have cracked while being boiled, and consequently might break without any force or carelessness on the part of the operator.

Mr. W. W. KING said that it was quite possible to remove foreign bodies of this nature from the bladder by means of bimanual manipulation. He had twice removed portions of catheter from the bladder by this method, and also on one occasion had similarly removed a metal thermometer case.

Mr. MILLWARD thought that it would have been quite easy to remove the foreign body with an operating cystoscopy.

Mr HERD (Liverpool) also pointed out how easily a glass catheter could be broken. He had seen a case recently where a catheter had been broken in the urethra during delivery by the pressure of the foetal head on the instrument.

Doctors WALSH and DOUGAL both described cases where they had removed pieces of slippery elm from the bladder after dilating up the urethra.

Mr. GLYN DAVIES, in reply, stated that the question of removing the foreign body by the vaginal route had been considered, but in view of the fact that the bladder had been involved in the carcinomatous growth and was very contracted, this method was not considered advisable.

MR. GLYN A. DAVIES, of Sheffield, cited a case of

ECTOPIC GESTATION

Case of Mrs. R., age 30.

History:

The patient had been married five years and had no children. In January, 1932, she was admitted as an emergency complaining of pain in the right side and vaginal bleeding. She said she had felt "something crack inside" ten days previously while carrying a bucket of water. Her doctor sent her to bed and two days before admission she had right-shouldered pain.

On the day of admission a laparotomy was performed and a right ruptured isthmial pregnancy with tubal mole almost extruded was found. A right partial salpingectomy and partial oöphorectomy was done. The left appendages were normal. She made an uninterrupted recovery.

On 30th August, 1933, she went to her doctor who sent her to Out Patients. She said she had had seven weeks amenorrhoea, believed she was pregnant, and as she intended to go away on holiday and feared the pregnancy might be "outside the womb" thought she ought to be examined. She had no symptoms except frequency of micturition. On examination the uterus was felt slightly enlarged and there was a somewhat movable cystic swelling on the right side. The left appendages could not be felt. A provisional diagnosis of (1) pregnancy with right ovarian cyst; (2) right ovarian cyst only; (3) right ectopic, was made, and she was admitted for observation. She was examined under gas and oxygen next day and the uterus felt about the size of a 7 weeks' pregnancy and the right ovary about four times its normal size. Nothing abnormal could be felt in the left appendages. It was then thought she had a uterine pregnancy, and it was decided that nothing should be done for 14 days at least, as the corpus luteum was probably in the cyst on the right side, and its removal might cause abortion.

Urine was sent for a Zondek-Aschheim test but the speciment was spoilt in transit, so a second specimen was sent some days later. The report on this came back positive on September 15th, after she had been in hospital 16 days. There were still no symptoms other than backache.

September 16th was visiting day and her husband came to see her. Immediately he arrived she collapsed in the ward with severe abdominal pain, worse on the left side, and referred to both shoulders. She was taken straight to the theatre, and on opening the abdomen it was found full of blood and a right ovarian cyst 4 ins. by 3 ins. "theca lutein", was exposed with no swelling in the right tube. A ruptured ectopic isthmial pregnancy was found in the left tube which was excised. The cyst wall in the right ovary and the corpus luteum of pregnancy which was present in that ovary were removed. There were many adhesions in the abdomen. Two days afterwards she passed a decidual cast. She made an uninterrupted recovery.

I think the points of interest are:

1. The common sense of the woman in going to her doctor when she thought she was again pregnant.

2. Her misfortune in that her only two pregnancies were ectopics.

3. Her good fortune in having the right ovarian cyst without which she might not have been admitted to hospital at all.

Discussion

Dr. JEFFREASON referred to the frequency of recurrence of ectopic gestation, and also stated that he had often found great difficulty in palpating a tubal pregnancy bimanually, even under anaesthesia.

Mr. W. W. KING said he thought recurrence of an ectopic gestation in the other tube was most uncommon, and he also was of opinion that rarely was evidence of infection in the tubes to be found. He said he would like to ask the opinion of the Society on the question of performing a salpingostomy at the time of operation or later.

Professor DOUGAL said he had reported on 100 cases of ectopic gestation with repeated ectopic gestation in six of these cases. In his cases the remaining tube had shown evidence of salpingitis in 50 per cent. Ten per cent of his cases had occurred in the first pregnancy soon after marriage, and he thought that in these cases the lesion in the tube was probably a congenital abnormality.

Mr. GLYN DAVIES, in reply, stated that there was no evidence whatever of salpingitis in these cases.

MR. JOHN CHISHOLM, of Sheffield, cited a case of

CHORION-EPITHELIOMA FOLLOWING FULL-TIME PREGNANCY

I should like to bring this case of chorion-epithelioma following full time pregnancy, to the notice of the Society.

The patient was a primipara, 31 years of age, who delivered spontaneously a live infant on May 26th of this year, at term. The pregnancy was uneventful, she was quite fit throughout, and the urine tested from time to time by the doctor never contained any albumin. The labour was short, its duration being under six hours, and following the completion of the third stage, there was no abnormal loss. A small perineal tear had three stitches inserted. The doctor tells me he saw nothing abnormal on examination of the placenta.

The lying-in period was quite satisfactory, no rise of temperature or pulse-rate occurred, and she was up on the fourteenth day after labour. She felt well the whole time. When she got out of bed on the fourteenth day a scanty brownish discharge was present

One month after delivery she passed a small clot, and again on the following two days, smaller clots were passed and her doctor being called in to see her at night on July 2nd, 37 days after delivery, found she had a temperature of 100. In view of the continuing discharge from getting out of bed, the passage of clots on the previous three days, and the temperature of 100, he thought she must have a low grade puerperal infection, and her admission to a puerperal sepsis bed at Norton was arranged for the following day.

On admission she was pale—her natural colour—T. 100 and P. 128. Nothing abnormal was found on examination of the abdomen. Vaginally, a little dark red discharge was present, not offensive. The cervix was small and appeared to be lightly fixed on the right side, the external os was

closed. The uterus appeared to be well involuted and mobile. A little tenderness was present in the right fornix. A swab taken from the cervix on admission showed streptococcus viridans. The temperature fell to normal on the following day and remained so for the next six days. The pulse during this time ranged from 90 to 100. An effort to give a small intra-uterine glycerine injection on the third day after admission was unsuccessful, as the catheter could not be introduced through the cervix. Six days after admission a bright red loss began about 6.30 a.m. and continued steadily though it was temporarily checked by an injection of ½ c.c. of pitocin. The pulse-rate rose and became of poor quality, so a pint of gum saline was given intravenously about 11 a.m. and at noon she was taken to the theatre. Under gas and oxygen anaesthesia a dilatation and exploration of the uterine cavity was carried out. A portion of tissue the size of a walnut was removed by the finger; it came away easily and I thought it was placental remains. The cavity was packed and ergot given. The patient's condition was poor but improved in the next 24 hours as the result of giving large quantities of fluid. The tissue removed was examined and reported as resembling chorion-epithelioma—but the report was not made to me and I continued in the belief that the tissue was placental. For the next five days the temperature rose to about 100.4 each night and the pulse ranged between 110 and 120, varying in quality.

A week after the exploration a trifling brownish discharge was still present but the temperature was now normal and pulse about 100, and I thought the patient was recovering from the mild uterine infection. On the 25th of July, 16 days after the exploration, she passed a large clot and again a steady loss occurred for a time. The uterus was packed after morphia had been given and the loss next day was trifling. Glauramine and glycerine was run into the vagina for several days following and small clots were passed with, at times, slight red loss, and vaginal examination showed a small uterus.

On August 3rd a note says that packing of the uterus which had been resorted to some four days earlier required less gauze each day and no loss occurred when the gauze pack was changed, but the day following bleeding was greater and after changing the plug 2 c.c. of haemoplastin serum was given. Then after a few days of improvement further bleeding recurred and a further exploration of the uterus under anaesthesia was carried out and a larger mass of placenta-like tissue was removed and this showed on microscopical examination definite chorion-epithelioma. On the day this report was received there was also available a report on urine taken some ten days previously for Aschheim-Zondek test. This report was positive.

Arrangements were then made for a pan-hysterectomy to be carried out. At the operation four days later all the tissues were found to be very friable —the uterus was torn in removal and a very small opening into the bladder also resulted though one used much care. This was closed by a layer of interrupted sutures and a second layer of continuous catgut. Bleeding was rather troublesome owing to infection. Following the completion of the operation, which the patient stood very well, a self-retaining catheter was placed in the bladder.

There was little of note during convalescence except that the temperature remained about 100 for the first week. The self-retaining catheter was removed in ten days' time. The patient went home three weeks after operation. Urine for Aschheim-Zondek test was reported as negative before she went home.

Since her return home patient has been quite well except for a cold with slight bronchitis which she had three weeks ago.

I have seen her this week and she is very fit but has trifling bleeding from the vaginal vault where there are two small granulations. Urine taken for Aschheim-Zondek test ten days ago is reported negative.

Pathological Report

A chorion-epithelioma, roughly globular in shape, measuring 1¼ inches by one inch by ¾ inches, is situated in the upper segment on the posterior wall of the uterus, and invading the wall to within one-quarter inch of the peritoneal covering. There are no theca lutein cysts of the ovaries.

Histology:

Haemorrhage is slight. Therefore the structure is not obscured. The section shows abundant proliferation of Syncitium and Langhan's cells, and deep invasion in vessels completely separated from the main mass of the tumour.

I would draw your attention to three points of interest this case presents.

(1) Chorion-epithelioma following full-time pregnancy in primipara.

It is well known that chorion-epithelioma occurs most frequently after vesicular mole and least frequently following full-time pregnancy. The percentage given by Vineburg being 21 per cent of cases.

(2) It followed the labour quickly. There was practically no latent period.

The period of latency between the last parturition, abortion of molar pregnancy and the discovery of chorion-epithelioma varies considerably. But the figures given by Ladinski in 1902, which are still quoted, show that the average time in his series was five weeks after full-time pregnancy. This case confirms with this period.

(3) The help given by the Aschheim-Zondek test in supporting this diagnosis, and also in watching the patient's progress after operation.

Is one entitled to assume from two negative Aschheim-Zondek tests at three months after operation that the patient is now quite well?

Discussion

Mr. JEFFREASON referred the Society to a recent American work on chorion-epithelioma. These workers had shown that it might follow a minor degree of hydatidiform degeneration of the chorion even though no typical hydatid mole was present.

Dr. WALSH stated that he had already reported one case to the Society where the Aschheim-Zondek reaction rapidly became negative after operation and had never again become positive.

Dr. CHISHOLM in reply stated that 50 per cent of chorion-epithelioma followed hydatid mole and that five per cent of these moles became malignant.

DR. A. LLOYD POTTER read a paper on

FUNCTIONAL UTERINE HAEMORRHAGE

Bleeding, occurring at regular intervals, is a normal function of the human uterus, between the age of puberty and the menopause.

Irregularity in this cyclical phenomenon, usually in the form of an increased loss, is one of the commonest symptoms for which a patient will seek the advice of a gynaecologist.

Although in many of these cases the symptom can be accounted for by the presence of some gross pathological lesion, such as fibromyomata or malignant disease, there still remains a large group of cases in which profuse uterine bleeding occurs in the absence of any obvious lesion. It is to this group that the term "Functional Haemorrhage" has been applied. Various types of this condition have been called, from time to time, menorrhagia, epimenorrhoea, epimenorrhagia, metrostaxis, menopausal bleeding and the like; each of these names describes the special features of a symptom common to all—excessive uterine bleeding.

To explain the pathology involved in the production of such bleeding, the term "Endometritis" was introduced by workers on the subject towards the end of the last century. This term, signifying as it does, a true infection of the endometrium, was generally accepted and used until the time of Hitschman and Adler who in 1907 showed that (1) most of the conditions previously described were ordinary cyclical changes, (2) some were a true hyperplasia, (3) inflammation of the endometrium was characterised only by the presence of plasma cells. Meanwhile, other authorities considered that irregular uterine bleeding was due to a myometrial, rather than an endometrial, disorder. They therefore introduced such terms as "Chronic Metritis", "Subinvolution" and "Fibrosis Uteri"—which are descriptive of their view of the underlying pathology in these cases.

These names, although still used at present and although presenting to the gynaecological mind a more or less clear picture of the clinical aspect of a case are incorrect pathologically, since they signify either an arrest of normal involution or an inflammatory process in the uterine musculature.

FLETCHER SHAW proved conclusively that in the majority of such cases, described as chronic metritis, there was no evidence of an inflammatory process in the myometrium, nor indeed was there an increase in fibrous tissue. He divided his cases into two groups:

(1) *Chronic Subinvolution*—including all parous uteri.

(2) *True Hypertrophy of the Myometrium* occurring in both parous and virgin uteri, which he said was due to the efforts of the muscle to expel a thickened endometrium.

Wilfred Shaw, as recently as 1929, published the results of an investigation into the involution processes occurring in a puerperal uterus, to show that subinvolution cannot be regarded as a cause of irregular uterine bleedings. His findings can be summed up in the statement that the elastic tissue content of a uterus is increased after each pregnancy and varies directly with the parity of a patient. This appeared to be of such great importance

that it was thought necessary to confirm it, for without confirmation it is impossible to be certain that the term chronic subinvolution is not both misleading and inaccurate when used to describe a case of excessive bleeding from a ' bulky ' uterus.

With this purpose in view, a series of sections was taken from uteri of varying parity. The specimens included uteri from cases of functional bleeding, fibromyomata, endometriomata, chronic salpingo-oöphoritis, and a normal uterus removed at post-morten examination.

Sections were also taken from the uterus of a foetus at term as a standard for comparative purposes. The stain used throughout was Werlhoff with a counterstain of Van Geisan.

Comparing this with the second slide which is taken from the uterus of an adult nullipara, demonstrates that there is very little difference in the elastic tissue content of the two. This is found in very small amount in the intima of the arteries and round some of the larger veins. Occasional strands are noticed between the larger muscle bundles, but, on the whole, the amount found in this position is almost negligible.

Passing now to the multiparous uteri, it is obvious that the elastic tissue is increased.

(*a*) The arteries show more elastic tissue in the subintimal layer and in the media.

(*b*) The increase in elastic tissue in the veins is apparent both in and outside the adventitia.

(*c*) Considerable deposits of elastic tissue are found between the muscle bundles and, after many pregnancies, between the actual muscle fibres.

(*d*) The elastic tissue content definitely increases with each pregnancy.

These points are, I think, readily demonstrated in the next few slides, taken from

a 3-para—note the layers in the arterial wall and the small deposits in between the muscle bundles;

a 4-para—again note the distribution in the artery and muscle;

a 5-para—note the increase over the two previous sections;

a 7-para—with a dense deposit in the subintimal and medial coats of the arteries, and also between the muscle bundles;

a 10-para—as above, with definite increase;

a 12-para—dense deposits in the artery walls, surrounding the vessels, and here actually between the muscle fibres.

These findings amply confirm Shaw's work, and it can therefore be stated that the elastic tissue content of a uterus bears a direct relation to the parity thereof, being in no way a sign of subinvolution, nor associated with the causation of functional bleeding.

I should like now to pass on to a discussion of the pathology of the functional uterine bleedings: 165 cases were examined, and it was found possible after correlating the histological findings with the clinical data, to classify them into several groups. The majority were contained in two groups, and for these the nomenclature used by Shaw and Cannon is followed, namely, *Metropathia Haemorrhagica* (the term used originally by Schröder), and *Epimenorrhoea*, as originated by Blair-Bell.

Metropathia Haemorrhagica:

Fifty-seven cases, or 34.5 per cent of the total, are included in this group, and although in most cases only curettings were available for examination, in 17 full specimens of uterus and ovaries were obtained. Clinically, this condition is characterized by either gradually increasing periods or continuous bleeding following a period of amenorrhoea, in women between the ages of 40 and 50. The majority are multiparae but it must be remembered that at this age most women have borne children. Bimanual examination reveals a uterus larger than normal—commonly described as ' bulky ', and in most instances, although no gross lesion can be found, one or other ovary is enlarged and cystic.

Passing now to the pathological side, examination of the specimens reveals many interesting features.

1. *Muscle.* In the 17 specimens available for examination of the uterus the enlargement was apparently due to a true hypertrophy of the muscle fibres. Microscopically, when compared with a normal uterus, the fibres are found to be slightly enlarged and the muscle bundles are well demarkated one from another. It has already been shown that elastic tissue is not responsible for the increased size of the uterus in metropathia haemorrhagica, and this was confirmed in every case.

2. *Endometrium.* In the majority of cases this structure was definitely thickened and polyp formation was of very common occurrence. The typical microscopical picture is one of an exaggerated intermenstrual or interval phase of normal endometrium, affecting both glands and stroma, but more easily demonstrable in the former. These are increased both in number and, in the majority of sections, in size. In fact, some may be described as showing cystic dilatation, although absence of tension is demonstrated by the tall columnar epithelium lining the glands. In a few instances cysts lined by flattened epithelium were seen—as in this section. These may be true retention cysts but their occurrence is extremely rare. Other features signifying overgrowth of the glandular elements are (*a*) *Invaginations,* in which part of the gland wall turns back into the lumen. In cross-section this gives the appearance of a gland within a gland. (*b*) *Tufts,* formed by areas of epithelium two-three layers thick. (*c*) *Adenomyosis*—or invasion of the superficial layers of the uterine muscle by the glands. This is said to occur in normal endometrium but it is more common to find it associated with hyperplasia, of which it may be said to be a characteristic feature. (*d*) *Cystic dilation* immediately beneath the surface epithelium.

3. *Ovaries.* Seventeen specimens only were available for examination, but the apearances were so consistent that they may be taken as typical of the condition. Follicular cysts—visible to the naked eye—were present in 15 of the ovaries, while in the remaining two, although the follicles could hardly be termed cystic, they were definitely larger than normal. These were confirmed microscopically in every case and it will be seen that the lining of these cysts consists of granulosa cells, several layers in thickness. Throughout the sections there was a singular absence of recent lutuem tissue and not one contained any active corpus luteum. It is well known that the fluid contained in follicular cysts contains oestrin, and this was confirmed

in two cases by having it injected into miniature female mice. It was noted that only very small quantities of the fluid were required to produce great enlargement of the uteri of these animals.

To recapitulate, therefore, the characteristic findings in metropathia haemorrhagica are:

(1) Follicular cysts in one or both ovaries with absence of corpora-lutea.

(2) Hyperplasia and hypertrophy of the endometrium involving both glands and stroma,, the former showing an exaggeration of the interval phase and undergoing none of the changes peculiar to the menstrual cycle.

(3) Hypertrophy of the uterine muscle.

What conclusions can be drawn from these features? It is generally accepted that two hormones are responsible for the maintenance of the integrity and functional activity of the endometrium, namely, oestrin and progestrin. The former produces growth of uterine musculature and builds up the endometrium from the post-menstrual to the inter-menstrual or interval phase, while the latter, the hormone of the corpus luteum, is essential for the production of premenstrual or secretory changes in the interval endometrium. Since it has been shown that in meropathia haemorrhagica the endometrial changes are typical of an exaggerated interval phase, premenstrual change being entirely foreign to the condition, the theoretical conclusion to be drawn is, that the abnormal features are due to prolonged or excessive action of Oestrin and to the absence of progestrin. This conclusion is borne out by the finding, in all the ovaries examined, of cystic follicles, with complete absence of corpora lutea. Further proof is lent by the work of Zondek and Frank, who demonstrated that not only is oestrin found in excess in the cystic follicles, but there are large amounts of this hormone in the blood and urine of patients suffering from metropathia haemorrhagica. Both these authorities state that the excess of oestrin is definitely responsible for the endometrial change.

Cannon takes the view that metropathia haemorrhagica is a reversion to the type of sex activity characteristic of such animals as the rabbit and the ferret. These remain on heat throughout the breeding season provided that copulation does not occur. They show a fibrocystic condition of the ovaries and evidence of prolonged activity of the oestrin-producing hormone. Later this passes gradually into anoestrins with degeneration of the unruptured follicle and bleeding into its cavity.

He compares this condition to that of metropathia haemorrhagica in woman, where withdrawal of the hormonic support is indicated by degenerative changes in the unruptured follicle and uterine bleeding.

It is well recognized that following partial resection of the ovaries in women, the remaining portion invariably tends to become cystic, indicating that we must look beyond the ovary for a cause of non-rupture of the follicle and for the unrestricted action of oestrin. Smith and Engle have shown that transplants of the pituitary into adult rats lead to the formation of cystic follicles in the ovaries. Hence, correlating this with the cyst formation after partial resection, it is evident that an excess of pituitary hormone acting on a normal amount of ovarian tissue, has exactly the same effect as a normal amount of pituitary acting on a diminished amount of

ovarian tissue. It is apparent, therefore, that the pituitary is the next link in the endocrine chain which is responsible for the condition of metropathia haemorrhagica. Hofbauer, in fact, produced experimental evidence to show that injections of anterior pituitary extracts into guinea pigs produced not only cystic follicles in the ovary but also endometrial hyperplasia. Thus it is evident that as Prolan A is the oestrogenic hormone, and since oestrin is present in excess in metropathia haemorrhagica, the latter condition is in all probability due to an excessive production of Prolan A, with possibly suppression of some hypothetical factor causing ovulation, but if ovulation is due to the removal of Prolan A from the circulation, no such hypothetical factor need be postulated and the continued action of Prolan A is sufficient to account for non-rupture of the follicle. Furthermore, by far the commonest age for the onset of metropathia haemorrhagica is between 40 and 50 or about menopausal age. Zondek and Fluhmann have demonstrated the presence of Prolan A in the urine and blood respectively of menopausal women. The former in discussing the reason for this suggests that the functioning ovary normally inhibits the activity of the anterior pituitary. Here again we have an indication that the primary cause of metropathia haemorrhagica is a pituitary dysfunction.

Epimenorrhoeal group: This, in the present investigation, constitutes the largest group of the functional haemorrhages, including 80 cases or 48.4 per cent of the total. It is most prevalent between the ages of 35 and 45 and, as you will see, tends to occur earlier in life than does metropathia haemorrhagica. Multiparous women again predominate and in a large number of the cases this type of bleeding dates from a confinement. The patient usually complains of an increased loss at the periods with a decrease in the total length of the cycle. Sometimes it is difficult to decide clinically to which group such a case belongs, as the interval may be so shortened that bleeding appears to be continuous. There are no physical signs specific to the condition. The uterus may be bulkly or normal in size and on occasion cystic ovaries are palpated. Pathologically it is difficult to present an adequate picture of all the varieties of endometrial changes which were observed in this condition but almost without exception the predominant feature was oedema of the stroma. This condition was uniform, usually throughout the whole thickness of the endometrium and always in the superficial 2/3. An oedematous endimetrium, of course, is one in which the cells are separated by fluid, in contradistinction to an endometrium showing a decidual reaction in which fluid is imbibed into the cells themselves. The only other notable finding in this group was an increase in the number of thin-walled capillaries in the endometrium, further evidence suggesting a hyperaemic condition being an exudate of blood throughout the superficial layers of the stroma, which was observed in a number of cases. The endometrium showed the ordinary phases of the menstrual cycle varying, of course, with the time of operation in relation to the cycle. Only nine ovaries were available for examination but the general picture suggested that there was hyperactivity of the follicular mechanism in that the Graafian follicles ripen and rupture too frequently. Thus ovaries from four cases contained two active corpora lutea of about the same age and appearance and

were obtained sufficiently early in the cycle to show that ovulation maintains its normal relation to the total length of the cycle. Perhaps an example will make this statement clearer. In one case the corpora lutea corresponded in appearance and maturity to one found on the 15th-16th day of a normal 28-day cycle, in which ovulation occurs between the 12th and 14th days. The specimen, however, was obtained on the 12th day of a 21-day cycle and thus ovulation must have occurred about the ninth or tenth day in this particular cycle. It is evident, therefore, that all the factors of the ovarian cycle are diminished in time, and here again it is probable that the pituitary and not the ovary is at fault. The findings indicate that not only is the anterior pituitary stimulus given to the gonad more frequently, but that it is often excessive. Epimenorrhoeal bleeding, unlike metropathia haemorrhagica, commonly occurs immediately after a pregnancy, and Shaw points out that during pregnancy the anterior lobe of the pituitary hypertrophies and leads to the secretion of large amounts of its hormone. He suggests that cases of post-partum epimenorrhoea might therefore be explained by assuming the persistence of activity of the anterior lobe with the result that follicles ripen and rupture too frequenly.

In suggesting an explanation for the characteristic feature of this condition, namely, oedema of the endometrial stroma, it must be remembered that its presence is independent of the phase of the endometrium. This suggests that the primary cause of the oedema as the action of oestrin, since this hormone acts throughout the whole cycle, while progestrin acts only during the premenstrual half of the cycle. Again, the latter hormone gives rise to a mild decidual reaction in which fluid is absorbed into the stroma cells, while oedema is essentially outside the cells—even in specimens examined during the premenstrual phase.

Why, you will ask, is not the same effect produced in metropathia haemorrhagica, in which oestrin is responsible for all the endometrial changes? One can only suggest that in the first group the action is prolonged rather than excessive, and the stroma has time to undergo a true hyperplasia. In the epimenorrhoeal group, on the other hand, the stimulus is extensive, occurring at frequent intervals, and the oedema must be regarded as a false hyperplasia.

About the remaining 17.1 per cent of cases, I propose to say very little, because the small number renders it impossible to form any definite opinion as to their causation or to explain the various phenomena related to them. Furthermore, I believe that all the essential pathology is contained in the first two groups and that if a reasonable nomenclature, suggesting their pituitary-ovarian origin, could be supplied, all cases of functional bleeding would be contained in these two groups.

A few cases in which all the factors of the menstrual cycle are prolonged, have been classified as a ***hypomenorrhoeal*** group, to indicate that it is apparently the opposite of the epimenorrhoeal group. The patients complain of excessive loss at the periods which however are at infrequent intervals. There are no characteristic findings pathologically but one would expect ovulation to be delayed due to lack of the normal pituitary stimulus.

Another small group includes cases of *post-menopausal* bleeding which

were obviously functional in origin, all gross lesions having been excluded. This group is important in that it demonstrates that the ovaries, and therefore the pituitary, continue their action for some little time after the menopause, as shown by cessation of menstruation, has been passed. Chalmers Fahmy describing such cases says " A study of this group leaves one not a little confused. In some the uterus is small, in other enlarged, in some the endometrium is hyperplastic, in others atrophic or apparently absent, in some the glands are cystic, in others small. The presence of follicular cysts in the ovaries has been noted in some instances, but because surgical removal of these organs has seldom been performed, histological examination has been prevented, etc. The onset of the menopause is judged clinically by amenorrhoea, but we cannot state yet at what later date the ovaries cease to exert control over the uterus, nor when the pituitary ceases to exert conrol over the ovaries."

Further, he states that " endometrial change is by no means a necessary prelude to uterine bleeding ", and the results of this investigation bear out the truth of this statement. For in all the cases included in the postmenopausal group, the histological picture was one of an atrophied endometrium, with deficient glands and a fibrous stroma.

There remains eight per cent of the total number of cases which are absolutely unclassified—the true misfits of this series. However, in spite of the varied clinical and histological findings, one feels that even here some ovarian or pituitary dysfunction is responsible for the altered menstrual cycle and for the symptoms common to all these functional cases—irregular —excessive haemorrhage.

Before leaving the subject, a brief word is necessary regarding the treatment of these cases. I do not intend to discuss the usual methods such as hysterectomy, resection of ovaries, radium and deep X-ray therapy, and curettage, except to stress the fact that the curette should only be regarded as an instrument for diagnosis and not for a cure. It is obvious, from what has been said, that the cause of all these haemorrhages is extrauterine and therefore no success can be hoped for by removing the thick endometrium without treating the underlying cause. For this reason hormone therapy would appear to be the ideal, but experience has taught us that there is still much to be learnt before this line of treatment can be regarded as a success.

In the groups of haemorrhages already described it is very difficult to decide theoretically which hormone should be used, except in the case of metropathia haemorrhagica. In this condition, in which corpora lutea are absent, it would seem reasonable to supply the deficient corpus luteum hormone to complete the endometrial cycle. Novak and Hurd attempted to influence the ovaries to produce a corpus luteum by the use of a luteumising substance from the anterior lobe of the pituitary, obtained from pregnancy urine. With such a hormone they succeeded in stopping bleeding in 44 out of 57 cases of the functional type, in most instances the effect being immediate. The authors admit, however, that it is almost impossible to obtain the hormone in sufficient quantity to affect the human uterus and ovaries. They consider that their results, therefore, were not

due to any effect on the uterus and ovaries, but suggest that the effect was brought about by a "neutralization" of the bleeding factor, which, as shown by Hartman, has a threshold at least 200 x less than that for the production of histological changes in the genitalia.

In the present investigation, however, success can only be claimed in the case of bleedings at puberty. Six cases were treated and the results were as follows:

1. Two cases, bleeding at the time of treatment ceased almost immediately and subsequently developed a normal rhythm.

2. Three returned to normal rhythm at the next period.

3. One returned to normal rhythm after a period of three months' amenorrhoea.

In each case the preparation used was Antuitrin S, prepared by P. D. & Co., from pregnancy urine, and said to stimulate the production of follicles when given in small doses, and lutein tissue when given in large doses.

However, it seems that this type of treatment in the present state of our knowledge is a 'hit or miss' method, and except in the case of puberty bleedings radio-therapy still appears to be the simplest and surest method of obtaining relief from the functional type of uterine haemorrhage.

Discussion

Professor DOUGAL raised the question of the interaction between the anterior pituitary hormone and the ovaries. He asked whether in the case of removal of one ovary the other ovary would go cystic owing to its being stimulated by an excessive quantity of pituitary hormone. He also asked why there should be haemorrhage in the interval stage of metropathia haemorrhagica, and also asked for an explanation of cure by curettage in such cases.

Dr. GERRARD expressed the opinion that dilatation and curettage cured some of these cases, and asked why this should be so if the haemorrhage was due to pituitary abnormality. He also observed that cystic ovaries were very frequently found in cases where there was no tendency to abnormal haemorrhage.

Dr. POTTER, in reply, stated that all cases of infection had been definitely excluded. He thought that the interval haemorrhage was in all probability due to removal of oestrin. He agreed that some cases might be cured by curettage, but stated that in these cases the condition was merely temporary. The symptoms would in all probability have subsided without any treatment. He stated that the so-called atrophic conditions of the endometrium might be associated with increase in the number of glands.

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